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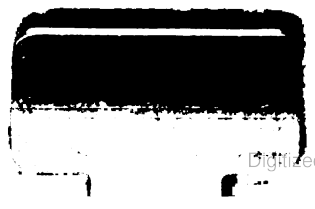

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MARYLAND WEATHER SERVICE
WILLIAM BULLOCK CLARK, Director

THE PLANT LIFE OF MARYLAND

BY

FORREST SHREVE, M. A. CHRYSLER,
FREDERICK H. BLODGETT
and F. W. BESLEY

(Special Publication, Volume III.)

THE JOHNS HOPKINS PRESS
Baltimore, 1910

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LETTER OF TRANSMITTAL

To His Excellency, AUSTIN L. CROTHERS,

Governor of Maryland.

Sir: I have the honor to present herewith the third volume of the new series of reports of the Maryland Weather Service. The first volume dealt in a general way with the broader physiographical and meteorological problems affecting the State at large. The second volume contained the results of a special study of the climate and weather of Baltimore and vicinity and is one of the most exhaustive reports of its kind that has ever been issued. The present volume embraces a discussion of the plant life of Maryland and allied subjects, the interpretation of which is largely dependent on the physiographic and climatic conditions which characterize the State. I am,

Very respectfully,

WILLIAM BULLOCK CLARK,
Director.

JOHNS HOPKINS UNIVERSITY,
December 1, 1909.

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PREFACE

The present volume is the third of a series of reports of the State Weather Service. The first volume was general in character and presented all that was then known regarding the physiography and meteorology of the State. The second volume presented the result of many years of exhaustive study of the climate and weather of Baltimore and vicinity and is one of the most complete reports of its kind ever issued anywhere. The present volume treats of the plant life of Maryland and associated topics, subjects intimately associated with and largely dependent upon the physiographic and climatic conditions. Not only has the distribution of plant life been found to be dependent upon the climate and physiography but also upon the agricultural soils which in turn find their ultimate interpretation in the underlying rocks from which they have been derived, thus bringing the work of the State Geological Survey and the State Weather Service into close association. Other lines of work suggested or inaugurated include a more detailed study of the swamp lands which are so intimately connected with the climatic conditions of the State, that their study, in part at least, falls within the province of the State Weather Service. The far reaching influence of climate on the economic and social development of communities suggests investigations upon the relation of agricultural soils to physiographic and climatic features, and the bearing of climates upon health.

A botanical survey of the State, especially with the view of determining the relation of natural vegetation to crop possibilities was undertaken in 1904 as a part of the climatic studies of the Maryland Weather Service. This work has been in charge of Dr. Forrest Shreve, now a member of the staff of the Desert Botanical Laboratory of the Carnegie Institution. He has had associated with him in the work Dr. M. A. Chrysler, of the Maine Agricultural College, and Messrs. Frederick H. Blodgett, W. Ralph Jones and Charles S. Ridgway.

Acknowledgements for material assistance are due to the Johns Hopkins University and to the Maryland Agricultural College, which are directly connected with the management of the State Weather

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Service, and to the State Geological Survey which is conducted in such active cooperation with the Maryland Weather Service in the investigation of the natural resources of the State. Aid has been rendered in the preparation of the present report by the officers of the U. S. National Herbarium and various other national bureaus such as the U. S. Weather Bureau, the U. S. Geological Survey, and the Bureau of Soils of the U. S. Department of Agriculture which have continued to actively cooperate with the State bureaus.

The *Introduction* to the present volume prepared by Forrest Shreve and constituting Part I, is devoted to a summary of the climatic factors of temperature, humidity, rainfall, and winds upon which plant growth depends; upon the topography of the State and its relation to vegetation and upon mineralogy and soils of Maryland and their bearing upon plant growth.

The chapter on the *Floristic Plant Geography of Maryland,* which forms Part II of the volume has also been prepared by Forrest Shreve and embraces a discussion of the distribution of the Maryland Flora both inside and outside the State.

The several chapters on the *Ecological Plant Geography of Maryland,* forming Part III of the volume, have been prepared by Forrest Shreve, M. A. Chrysler, and Frederick H. Blodgett, the former discussing the Eastern Shore, the Lower Midland, and the Mountain districts while Mr. Chrysler describes the Western Shore District and Mr. Blodgett the Upper Midland District.

The Relation of Natural Vegetation to Crop Possibilities by Forrest Shreve forms Part IV of the volume and discusses features of much interest to the agriculturalists of the State.

Part V by Frederick H. Blodgett treats of the *Agricultural Features of Maryland,* and embraces a full discussion of the agricultural practise and the chief agricultural products of the State.

The Forests and Their Products by F. W. Besley, the State Forester, forms Part VI of the volume and Part VII consists of an annotated *List of Plants Collected or Observed* compiled by Forrest Shreve.

Mr. E. W. Berry of the State Geological Survey, has rendered efficient service in the publication of the present volume by editing the manuscripts presented and in supervising their passage through the press.

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MAP OF MARYLAND SHOWING THE FLORISTIC ZONES AND ECOLOGICAL DISTRICTS.

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PART I

INTRODUCTION

BY

FORREST SHREVE

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INTRODUCTION

BY

FORREST SHREVE

Maryland, although ranking as the eighth smallest state of the Union, is so carved out as to comprise a diversity of natural conditions out of all proportion to its area. Its greatest length is some 320 miles measured in an ESE-WNW direction. This axis is nearly at right angles to the general trend of the Alleghany Mountains, of the various geological formations and of the "Fall-line." The state is thus, in effect, a narrow cross-section of the Coastal Plain, of the Piedmont Plateau and the Alleghany Ridges, extending from the ocean over into the drainage basin of the Mississippi River. The elevations pass gradually from sea-level to 3,342 ft., near Table Rock in Garrett County. While the north and south extent of the state is not great (250 miles at its greatest point), yet it lies between the North and the South and is a meeting ground for plants of northern and southern range. Together with differences of altitude and distance from the sea, go differences in climate in the eastern and western parts of the state, as well as striking differences in topography. The geological formations range from the most ancient granite and gneiss, through rocks of every age and great mineralogical diversity, down to the coastal deposits of recent times. Overlying these varied rocks and deposits are a diversity of soils, which have been nowhere covered by glacial action, as in the neighboring states to the north. Through the middle of the coastal portion of Maryland stretches the Chesapeake Bay with its great system of estuaries, varying the topography, modifying the climatic conditions and bringing about constant changes in the distribution of plant communities.

All of the above mentioned features are such as tend to give variety to the plant life and to render interesting the study of the botanical features of even so small an area. The very fact of the existence of

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a large mass of data on the topography, geology, soils, climatology and other natural features of Maryland has rendered it a particularly favorable area for the prosecution of such work as is outlined in this volume.

The study of the plant life of a specified area, as a state or nation, falls naturally into two phases, one dominated by the view-point of systematic botany, the other by that of ecological or physiological botany. The first of these phases, *Floristic Plant Geography,* has to do with the geographical aspects of the completed work of systematic botany. That is to say, after the describing and listing of all species of plants found growing in the area, Floristic Plant Geography then endeavors to show what families and genera of plants are most abundantly represented in species, what are the relationships of the flora to that of neighboring areas, what are the probable sources and paths of migration of the species which have entered the area from without and what are the bounds of distribution of the species not found throughout the area. Such a study is concerned with individual plants only as they go to make up the collective representation of the species. All the plant species of an area considered collectively, and from the systematic view-point, constitute its *flora.*

The physiological phase of the study of the plant life of particular areas, *Ecological Plant Geography,* is not at all concerned with the systematic relationships of plants, but rather with their form, structure and functions, and the relation which these bear to the physical and organic environment of the individuals. Carrying out studies in the Physiological Plant Geography of a region demands a knowledge of the climate, geology, topography and soils, and of the structural and functional characteristics of the plants themselves. It endeavors to answer the questions: what physiological types of plants are dominant in the region, in what manner are the plants associated together and how do these associations vary from place to place; what are the influences of the mineralogical character or the texture of soils in determining the nature of the plant life, and what relation to topography, soil moisture, wind and other factors have to the distribution of the different types of plants and plant associations? All the plant individuals of an area considered collectively and from the physiological view-point constitute its *vegetation.* To speak of the

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"flora of Maryland" is to speak of its plants considered from the systematic view-point as members of families, genera and species; to speak of the "vegetation of Maryland" is to allude to its plants from the physiological view-point as being trees, shrubs or herbs, as being aquatic, palustrine or terrestrial, as independent, saprophytic or parasitic, as hygrophilous, xerophilous or succulent, and the like.

There has not yet been made a complete enumeration of the plants of Maryland, and we cannot therefore enter on a detailed consideration of the Floristic Plant Geography of the state. As much as may be said with the material now on hand forms the subject matter of Part II. of this volume. The flora of Maryland is that of the Middle Atlantic states,—the greater number of its species range beyond its borders northward to New England and the Maritime Provinces, westward to Michigan and Missouri, or southward to the Carolinas and Georgia. The mountainous western part of the state has many species ranging northward, the coastal counties are rich in species ranging southward. This results in a marked difference in the flora of the mountain, midland and coastal parts of the state. Differences of flora are known to have their basis partly in the past history of plant distribution and migration, and partly in the present climatic conditions, of which temperature and rainfall are the chief. In Maryland the temperature differences between the Mountain and Midland Zones may be held accountable for their floristic differences, but between the Midland and Coastal Zones other factors take precedence in causing the distinctness, a matter which will be discussed in Part II.

The principal subject matter of this volume is the Ecological Plant Geography of Maryland, which is here treated in its general descriptive phases. Maryland lies in the midst of a region in which the dominant vegetation is the deciduous forest, a type of plant life found to characterise all regions in which there is an abundant rainfall well distributed through the growing season, together with a cold or dry season lasting for a few months. Before settlement by Europeans the present area of Maryland was undoubtedly covered by continuous forest. Only here and there were there restricted areas of marsh, bog or bare rock, in which local conditions hostile to tree

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growth offset the favorable climatic conditions of the region as a whole.

The forests of Maryland differ from place to place in the tree species of which they are made up or in the relative proportion of the component species. Such differences are of two kinds,—(*a*) the difference between forests in widely separated sections of the state, which are due to the occurrence of tree species in the one section which do not range into the other, and (*b*) the difference between forest growths which are near together but occupy situations which are different in soil, in the amount of soil water, etc. The first of these differences in types of forest is floristic and has its basis in those historical and climatic causes to which allusion has already been made; the second is an ecological difference, and is due to local conditions only. A study of the forest types of an area so small as to have a uniform flora and climate, for example one of the counties of Maryland, brings out the importance of the aforesaid local conditions. Of these the most important is the water content of the soil, a feature which is of vital importance to the physiological processes of the plant.

The soil-water is not alone the only source of water for terrestrial plants but is also the source of their mineral and nitrogenous food-substances. The aerial parts of plants are constantly losing water by transpiration, a process analogous to evaporation but subject to control by the plant within certain limits. Such water-loss is met by the supplies of water derived by root-absorption from the soil-water. In order that a plant may maintain its turgidity and perform all its nutritive processes in a normal manner it is necessary that the amounts of water absorbed and transpired be nearly equal. The amount of transpiration exhibited by a plant is partly due to its specific characteristics of leaf size, leaf structure, etc., partly to various physiological controls exerted by the plant to a different degree at different times, and partly to the physical factors of the environment, heat, humidity, light (as transformed to heat in the leaves) and wind. These atmospheric factors are much more uniform over any county of Maryland than are the amounts of soil-water. The fact that all plants actually do maintain a balance between absorption and transpiration in the face of the uniformity of

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the atmospheric conditions and the wide differences in soil-water supply from habitat to habitat, goes to show that it is in the specific peculiarities of leaf size and leaf structure that we must look for the chief means for the maintenance of the balance. An abundant supply of soil-water renders easy the maintenance of the balance and favors the occurrence of plants with broad thin leaves (*hygrophytes*), the scarcity of soil-water renders difficult the maintenance of the balance and conditions the occurrence of plants with small or leathery leaves and various peculiarities of anatomical structure (*xerophytes*). We thus see the fundamental importance of the amount of soil-water in determining the character of vegetation, and it is in turn dependent upon the physical texture of the soil and upon the topography.

Not only is the amount of the soil-water of importance but also the character of its dissolved contents. The existence of a considerable percentage of common salt in the water of salt marshes renders the existence there of ordinary plants an impossibility. It serves also to render absorption slight even in salt plants, because the salt is useless to the plant and cannot be got rid of, therefore accumulating in the tissues to an amount that is ultimately sufficient to be toxic. Although water is so abundant in salt marshes it is unavailable to plants and they are thus subjected to difficulty in maintaining the balance between absorption and transpiration in much the same manner as are plants of dry habitats. In the upland too, there are lesser differences in the chemical character of the soil-water due to the nature of the rock from which the soil particles have been derived, and these differences are of some importance in determining the local distribution of plants. The great generality of rocks contain a variety of chemical elements, such that the soils derived from their disintegration yield all the inorganic substances necessary to the growth of plants. The soil-water, which is in such intimate contact with the mineral particles of the soil, exerts a continuous solvent action upon these particles and thus brings into solution a variety of inorganic salts in amounts varying with their solubility. The compounds of silicon and aluminum, which make up such a large percentage of the composition of granites, shales, schists, gneiss and other rocks, are highly insoluble and accordingly remain as the chief solid constituents of the soils derived from these rocks. Small percentages

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or even mere traces of salts of calcium, magnesium, potassium, sodium, sulphur and iron are also present in the above-named rocks. These elements are all of vital importance in plant nutrition and they commonly occur in the form of salts which are readily soluble. The supplies of dissolved salts in the soil-water are being continuously carried away through the washing, or leaching, of the soil by rainfall, so that it is possible for a soil to become poor in a readily soluble salt which is abundant in the rock from which the soil was originally derived.

The soils derived from the rocks mentioned in the last paragraph are designated *silicious,* and they contain all the inorganic salts necessary to plant growth, without containing any of these in such large amounts as to be harmful or toxic, save in the case of soils derived from serpentine rock, of which more will be said later. The soils derived from limestone are so rich in calcium as to be distinctive in their relation to plant nutrition, and are designated *calcareous.* The influences of silicious, serpentine and calcareous soils on the metabolism as well as the distribution of plants will be noted at greater length on a subsequent page.

It must be evident that those relations which the vegetation bears to local factors of soil, topography and the like, are most clear only in areas which have not suffered modification by man. In virgin forests and undisturbed marshes the vegetation is of such a character that it will remain the same in its appearance and make-up from decade to decade,—that is to say it has reached a condition of stability which represents a nearly perfect balance between the life processes and the physical conditions under which it exists. Where extensive clearings exist and scarcely any areas of virgin forest remain, as is the case in Maryland, it is extremely difficult to reconstruct a picture of the virgin vegetation, and equally difficult to draw wholly satisfactory conclusions as to the relation between natural vegetation and the physical conditions. Particularly is the character of the forests changed by clearing. This results in part from the selection by the lumberman of certain tree species and the leaving of others, in part from the altered conditions of soil due to clearing or to subsequent fires, and yet again to the chance conditions which may determine the re-seeding of an area.

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The only methods by which it is possible to obtain any notion of the relation of natural vegetation to soils and other conditions are to select for study areas which have long been undisturbed, and to disregard the occurrence of such plants as are tolerant of a wide diversity of conditions. To the last-named class belong the majority of our weeds, which indeed owe the fact of their being weeds to this very characteristic, together with their powers of seed production and dissemination. The pursuit of these methods over as large an area as an entire state renders it possible to draw at least some broader conclusions, which will be found throughout the following pages.

Together with the scientific aim of presenting a picture of the vegetation of Maryland and its distribution, the present work has been carried on with a view to discovering relations between the natural vegetation and the crop possibilities of definite areas. That such a relation might be expected to exist follows naturally from the fact that spontaneous vegetation and cultivated crops on the same soil in the same place are subject to identical climatic conditions and closely similar conditions of soil. That such a relation actually exists has been shown in a few well-marked cases. The tracing of relations between natural vegetation and cultivated crops is rendered extremely difficult by two sets of considerations. The first of these is the disturbance of the natural vegetation which has taken place, to which allusion has already been made. The second is the fact that the tillage, drainage, fertilization and other processes of treatment of cultivated land, may often go so far toward making a radical change of soil texture or of the water and food content of the soil as to insure the success of a crop to which the area was at first not adapted. The more marked the physical conditions of a habitat are, the more dogmatic may one be in interpreting its crop possibilities. The less marked are the conditions, that is the nearer they come to the optimum for the great generality of plants, the more difficult it is to draw conclusions of other than very general bearing. These matters are taken up more in detail in Part IV.

The succeeding pages of the Introduction are devoted to a brief presentation of those features of the Climatology, Topography, Mineralogy and Soils of Maryland which are of importance in determining the distribution of plant species and plant communities.

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All of these physical features of Maryland have been treated in detail in previous publications of the Maryland Weather Service, and in those of the Maryland Geological Survey and the United States Soil and Forestry Bureaus, to the most important of which publications reference is made in the Bibliography at the close of the chapter.

Part II. deals with the Floristic Plant Geography of the state, in which the three floristic zones, the Coastal, Midland and Mountain, are characterised, and their principal features discussed. (See Frontispiece.) The succeeding chapters take up the Ecological Plant Geography of the five Ecological Districts of the state, into which the Floristic Zones have been subdivided. The Coastal Zone is subdivided into the Eastern Shore District and the Western Shore District, the portions of the Coastal Plain lying east and west of the Chesapeake Bay, respectively. The Midland Zone is subdivided into the Lower Midland District and the Upper Midland District, the boundary between them being Parr's Ridge. In the Mountain Zone no subdivision has been made.

CLIMATOLOGY.

Those various elements of temperature, rainfall, humidity, etc., which we designate collectively as the *climate* are of fundamental influence on the vital processes of plants. In the study of the influence of each of these climatic elements, or environmental factors, on the physiological processes of plants they are found to possess minimum, optimum and maximum intensities. There is, for example, an optimum temperature for growth in each species which may not be the same as the optimum temperature for transpiration or photosynthesis in the same species. Since, however, the separate processes of an individual plant operate in harmony, there is a given temperature which is the physiological mean of the optimum temperatures of the separate processes, which is designated the *ecological optimum.* In the general consideration of the influence of climate on the vegetation of larger areas it is necessary to confine the attention to the ecological optimum.

The climatic factors which are of the greatest importance in relation to the vegetation are temperature and rainfall, the first of which is almost exactly uniform over areas of considerable extent, while

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FIG. 1.—VIEW SHOWING DEPRESSION IN CLAY UPLAND SWAMP, ISNARDIA AT THE LEFT, MYRIOPHYLLUM AT THE RIGHT AND DANTHONIA IN THE BACKGROUND, NEAR CASTLE HAVEN, DORCHESTER COUNTY.

FIG. 2.—VIEW SHOWING SANDHILLS ALONG MARSHYHOPE CREEK, NEAR FEDERALSBURG, CAROLINE COUNTY.

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the latter is modified in its influence by local differences of soil, topography, etc. The rainfall, for example, is practically uniform over the whole of Worcester County, yet the rain which falls upon the dunes at Ocean City soon sinks to a level at which it is unobtainable by the vegetation, while that which falls upon the clay soils in the interior of the county is retained in the surface layers. Important to vegetation, but in a less degree, are humidity, sunshine, wind, fog and other elements of the climate.

Temperature.—The most fundamental influence of temperature in an area is the excluding of all plants except those whose ecological optimum of temperature approaches the mean temperature of the growing season of the area. The native, introduced, and cultivated plants of Maryland find in its mean temperatures such as are more or less closely approximate to their optimum; plants of the tropical and sub-tropical regions to the south are excluded from occurrence either by the direct fatal effect of freezing temperatures or by reason of the relative shortness of the growing season to their habits of growth, flowering and setting seed. Plants of northern and arctic regions are excluded either by reason of the competition of the more accurately adapted plants, or, as has been suggested by Merriam*, by the harmful effect of the temperatures of a few weeks in the hottest part of the summer. A most important end-effect of the temperature is, then, the determination of the character of the flora,—there are certain strictly tropical families and genera, and others which occur solely or chiefly in the temperate or the arctic regions, a matter, however, into which the geological history of floras enters as an important consideration.

A second influence of temperature is the regulation of the periodic phenomena of plants,—the date of germination for annuals or of leafing-out for perennials, the date of flowering, of the ripening of fruit or seed, the date of leaf-fall or death, etc. The annual curve of temperature for all regions lying within the North Temperate Zone rises during the spring and summer months to a maximum and falls in the autumn and winter to temperatures which may be below those

*Merriam, C. Hart, Laws of the Temperature Control of the Geographical Distribution of Terrestrial Animals and Plants, National Geographical Magazine, Vol. VI., 1894, pp. 229-238.

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required by plants. The amplitude of the curve varies from place to place, and the time during which it is below the ecological optimum for the majority of plants increases as we pass from the Tropic of Capricorn to the Arctic Circle, in other words the growing season decreases in length as we pass northward in the North Temperate Zone. The manner in which the length of the growing season affects plants is different in different species. In sub-tropical Florida perennial plants maintain continued activity and herbaceous plants spring up and come to maturity without relation to the time of the year. Further north, in the latitude of Maryland, some of the perennial plants, as our deciduous forest trees, become adjusted to the winter season through leaf-fall, while other perennial plants, as our pines and cedars, are permanently adjusted through the form and structure of their leaves to the unfavorable conditions of winter. The annual plants in this latitude are brought into unison so as to all germinate, grow and set seed during approximately the same months of the year. Still farther north, near to the Arctic Circle, the shortness of the growing season gives the evergreen conifers an important place numerically among the woody perennials, while the herbaceous plants are either adjusted to the length of the season by rapidity of development, or capable of withstanding arrest of development through a freezing temperature, and of continuing their development without backset on the return of spring.

It is important to bear in mind that it is not the coldness of the winter which determines directly the habit of leaf-fall in deciduous trees, but that this phenomenon, which is equally observable in the trees of the tropics in different months of the year, is brought into unison in the temperate zones and prolonged through the existence in winter of conditions unfavorable to the absorption of soil-water by roots,—namely the frozen condition of the soil or its low temperature. In the coniferous evergreens the balance between absorption and transpiration is maintained during the winter through the form and structure of the leaves, not, however, without a consequent restriction of their capacity for activity during the favorable summer season. In the perennials of the temperate zone the low temperatures of winter are not fatal and the features of structure sometimes supposed to be protective against cold,—hairy or viscid winter buds,

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etc.,—are merely protective against sudden changes of temperature, which are more injurious than the low temperature in itself. There are, nevertheless, many plants whose protoplasm is not capable of withstanding a temperature of 32°, or even a few degrees above this, except in the resting state of the seed, in which the water content of the protoplasm is low.

Considerations regarding the length of the growing season and the effect of the annual march of temperature upon the growth and periodic phenomena of plants are of great theoretical and practical interest. The attempt has been made repeatedly to establish a definite mathematical relation between the stages in the annual march of temperature and the seasonal changes in the growth and periodic phenomena of plants. These attempts constitute the science of *phenology,* for the history of which the reader is referred to a recent publication by Professor Abbe*. The principal attempt of phenology has been to show that the same plant species reaches the same stage of development or exhibits the same periodic phenomena in different locations, or in different years at the same location, when it has received a particular total amount of heat, or a particular proportion of the total heat of the growing season. This attempt has been beset with many difficulties, as are all attempts to establish biological laws on *a priori* grounds. On the side of the temperatures it is necessary to establish an arbitrary starting point from which to begin the addition of the number of degrees; it is necessary to use the degrees of temperature as observed in the shade or else to secure insolation temperatures, which cannot be reliably measured; it is necessary to ignore the fact that some of the light rays falling upon the foliage are converted into heat which is available to the plant. On the side of the plant it is necessary to ignore the physiological difference between the germination of annuals and the leafing-out of perennials; it is necessary to ignore the fact that a given ten degrees of the thermometrical scale are not physiologically equivalent to any other ten degrees above or below these; and above all it is necessary to ignore the fact of the influence upon the plant of many other external factors

*Abbe, Cleveland. A First Report on the Relations between Climates and Crops. Bulletin 36, United States Weather Bureau, Washington, 1905.

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which may accelerate or retard the effect of a given number of degrees of total heat.

Various attempts have been made to re-adjust phenological theory to fit the facts, as for example, the proposal of Quetelet to take for comparison the squares of the sums of temperatures, and that of von Oettingen to consider the proper temperature for the starting point for the addition of degrees to be that which gives results that best serve to make observations on the plant concordant with theory. In spite of the futility of the formal aim of phenology there is the high-

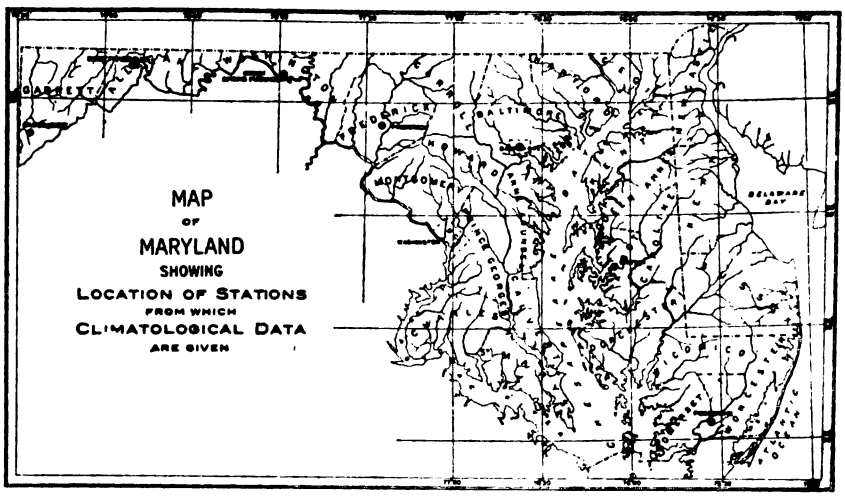

FIG. 1.—Map of Maryland Showing Stations from which Climatological Data Are Given.

est importance to be attached to the duration of the growing season for plants and to the character of the annual curve of temperature both as respects the duration of the highest temperature of summer and the lowness of the minimum temperatures of winter.

It is only in a general study of the relations of temperature to the character of the flora and the march of periodic phenomena in areas of considerable size that any value attaches to the comparison of annual or monthly means, seasonal or monthly mean maximum and minimum or daily ranges. Owing to the geographical position of Maryland and the increasing altitudes encountered in passing from the coast to the westernmost county there are differences in the climate as respects temperature which are of importance to vegetation.

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The climatology of Maryland has received exhaustive treatment in the first two volumes of the publications of the Maryland Weather Service and in the County Reports of the Maryland Geological Survey. For all detailed information as to the climatology of the state the reader is referred to these publications. It is my purpose here to set forth only a few of the most general features of climatology which are of direct importance to vegetation.

For purposes of comparison of the temperature and rainfall of the different sections of the state I have secured data covering the eleven years from 1893 to 1903 for seven places about equidistant from each other along the longest axis of the state. These stations which may be located by the accompanying map are as follows:

Station	County	Zone	Altitude
Sunnyside	Garrett	Mountain	2500 ft.
Boettcherville	Allegany	Midland	780 ft.
Green Spring Furnace	Washington	Midland	450 ft.
Frederick	Frederick	Midland	275 ft.
Baltimore		Midland	123 ft.
Easton	Talbot	Coastal	35 ft.
Pocomoke City	Worcester	Coastal	37 ft.

TEMPERATURE.—FOLLOWING ARE THE TEMPERATURE DATA:

Mean Monthly and Annual Temperatures, 1893-1903.

	Sunnyside.	Boettcherville.	Green Spring Furnace.	Frederick.	Baltimore.	Easton.	Pocomoke City.
Jan.	26.3	29.5	30.8	31.1	33.2	33.2	38.1
Feb.	23.6	29.3	30.1	31.3	32.9	33.2	36.2
Mar.	37.0	41.4	42.0	43.1	43.7	44.6	47.8
Apr.	45.4	51.5	51.6	52.9	53.3	53.1	54.8
May	57.2	63.4	63.5	64.0	64.2	63.7	65.2
June	64.0	70.9	70.9	71.8	72.3	71.2	73.2
July	68.3	74.8	75.8	77.1	77.7	77.0	78.5
Aug.	66.3	72.4	73.8	74.6	75.5	75.1	76.6
Sept.	60.9	66.1	67.2	68.3	69.3	69.4	71.0
Oct.	49.5	53.9	54.2	56.3	57.6	57.6	60.9
Nov.	38.0	42.7	43.4	44.9	46.4	46.1	51.5
Dec.	28.9	32.9	32.5	34.8	36.8	36.7	41.7
Year	47.1	52.4	53.0	54.2	55.2	55.1	58.0

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Monthly and Annual Mean Maximum Temperatures, 1893-1903.

	Sunnyside.	Boettcherville.	Green Spring Furnace.	Frederick.	Baltimore.	Easton.	Pocomoke City.
Jan.	35.1	41.4	39.2	38.1	39.6	40.7	47.0
Feb.	33.3	39.9	39.1	39.2	39.9	41.5	45.1
Mar.	47.6	55.8	52.6	52.0	51.7	54.0	58.1
Apr.	56.6	65.0	63.7	63.5	61.8	63.5	64.4
May	70.6	80.2	76.2	75.4	73.2	74.3	75.1
June	76.2	85.6	83.3	82.8	81.2	80.9	82.5
July	80.4	91.7	88.5	87.9	86.4	86.3	87.2
Aug.	79.6	88.6	85.6	85.3	84.1	84.6	85.1
Sept.	74.5	82.4	81.3	79.2	78.1	79.7	80.1
Oct.	63.3	70.5	65.6	66.3	65.9	67.7	70.5
Nov.	48.7	53.1	53.5	53.7	53.8	55.4	60.8
Dec.	37.7	42.0	41.3	42.4	43.5	44.9	51.0
Year	58.6	66.4	64.2	63.8	63.3	64.5	67.2

Monthly and Annual Mean Minimum Temperatures, 1893-1903.

	Sunnyside.	Boettcherville.	Green Spring Furnace.	Frederick.	Baltimore.	Easton.	Pocomoke City.
Jan.	17.5	21.9	22.5	24.2	26.8	25.8	29.1
Feb.	14.2	18.2	21.0	23.3	26.0	24.8	27.3
Mar.	26.2	31.2	31.5	34.1	35.8	35.2	38.5
Apr.	34.1	37.4	39.6	42.3	44.7	42.7	45.1
May	44.1	48.6	50.7	52.6	55.2	53.2	55.4
June	51.0	56.4	58.6	60.7	63.4	61.3	63.9
July	56.3	61.4	63.3	66.3	68.9	66.7	69.7
Aug.	53.4	60.1	61.9	63.9	67.0	65.6	68.1
Sept.	47.4	52.1	54.2	57.3	60.6	59.1	62.0
Oct.	35.8	42.6	42.8	46.4	49.2	47.5	51.2
Nov.	28.0	31.2	33.4	36.2	38.7	36.9	41.4
Dec.	19.0	21.5	23.6	27.2	30.0	28.5	32.4
Year	35.6	40.2	41.9	44.5	47.2	45.6	48.7

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Monthly and Annual Mean Daily Range of Temperature, 1893-1903.

	Sunnyside.	Boettcherville.	Green Spring Furnace.	Frederick.	Baltimore.	Easton	Pocomoke City.
Jan.	17.6	19.5	16.7	13.9	12.8	14.9	17.9
Feb.	19.1	21.7	18.1	15.9	13.9	16.7	17.3
Mar.	21.4	24.6	21.1	17.9	15.9	18.8	19.6
Apr.	22.5	27.6	24.1	21.2	17.1	20.8	19.3
May	26.5	31.6	25.5	22.8	18.0	21.1	19.7
June	25.2	29.2	24.7	22.1	17.8	19.6	18.6
July	24.1	30.3	25.2	21.6	17.5	19.6	17.5
Aug.	26.2	28.5	23.7	21.4	17.1	19.0	17.0
Sept.	27.1	30.3	27.1	21.9	17.5	20.6	18.1
Oct.	27.5	27.9	22.8	19.9	16.7	20.2	19.3
Nov.	20.7	21.9	20.1	17.5	15.1	18.5	19.4
Dec.	18.7	20.5	17.7	15.2	13.5	16.4	18.6
Year	23.0	26.2	22.3	19.3	16.1	18.9	19.5

A comparison of the mean annual temperatures for Sunnyside (47.1°) and Pocomoke City (58.0°) shows a difference of 11° between these most widely separated stations. That the difference between the means for Sunnyside and Boettcherville (5.3°) is greater than that between any other two stations is to be attributed to the greater difference of altitude and to the influence of the main ridge of the Alleghanies upon the prevailing north-west winds of the winter months. The difference in the mean temperature between Green Spring Furnace and Easton is only 2°. The difference of 3° between Easton and Pocomoke City is to be attributed to the nearness of the latter station to the ocean, as well as to the presence of a large body of water to the west of it, and to its more southerly location.

The annual mean maxima exhibit about the same relation as do the annual means,—that is the differences between Sunnyside and Boettcherville (7.8°) and between Easton and Pocomoke City (2.7°) are greater than the entire difference between Boettcherville and Easton (1.9°). The difference between the annual mean minima of Sunnyside and Pocomoke City is 13.1°, as contrasted with a difference of 8.6 between their mean maxima, indicating a greater differ-

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entiation of winter than of summer climate in the state. The data showing the mean daily range of temperature indicate a maximum of 26.2° for Boettcherville, ranges which are nearly the same for Sunnyside and Green Spring Furnace, and appreciably lower ranges for the other four stations, with a minimum of 16.1° for Baltimore.

The length of the growing season is a datum which must be determined for each plant species in order to have physiological value, owing to the specific differences of plants as respects the temperature which serves to awaken them to activity in the spring and to cause them to die or to resume winter dormancy in the autumn. For the purposes of Floristic Plant Geography we may, however, very well contrast the differences in length of growing season in the different parts of Maryland by ascertaining the number of days falling betweeen the last vernal and first autumnal occurrence of certain low temperatures. The freezing point is the temperature which is of the most uniform influence in the demarcation of the growing season, particularly upon its termination, for it is only by the occurrence of heavy frosts that the foliage of deciduous trees ceases to be functional and annual plants die. As respects the commencement of the growing season the last occurrence of a minimum temperature of 32° is not equally significant, for many plants begin activity before the date of its occurrence and many others not until after. For the purpose of estimating the length of the growing season in different parts of Maryland two sets of data have been secured,—the first showing the number of days between the last occurrence of 32° in the spring and its first occurrence in the autumn, the second showing the number of days between the last and first occurrence of 40°, a temperature arbitrarily chosen as being about that at which light frost may occur, and above which most plants of the native flora may be at least somewhat active.

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DATE OF LAST MINIMUM TEMPERATURE OF 32° IN SPRING; AND OF FIRST MINIMUM TEMPERATURE OF 32° IN AUTUMN.

	Last in Spring. (Average Date) 1893-1903.	First in Autumn. (Average Date) 1893-1903.	Length of Interval in Days.
Sunnyside,	May 16th,	September 15th,	122
Boettcherville,	April 26th,	October 4th,	161
Green Spring Furnace,	April 20th,	October 12th,	175
Frederick,	April 10th,	October 25th,	198
Baltimore,	April 4th,	November 14th,	224
Easton,	April 10th,	November 2nd,	206
Pocomoke City,	April 16th,	November 7th,	205

DATE OF LAST MINIMUM TEMPERATURE OF 40° IN SPRING; AND OF FIRST MINIMUM TEMPERATURE OF 40° IN AUTUMN.

	Last in Spring. (Average Date) 1893-1903.	First in Autumn. (Average Date) 1893-1903.	Length of Interval in Days.
Sunnyside,	July 5th,	August 31st,	57
Boettcherville,	May 27th,	September 15th,	111
Green Spring Furnace,	May 18th,	September 24th,	129
Frederick,	May 2nd,	October 3rd,	155
Baltimore,	April 24th,	October 16th,	175
Easton,	May 10th,	October 8th,	151
Pocomoke City,	April 25th,	October 14th,	172

These figures show a marked contrast between the extreme stations in Garrett and Worcester counties, a difference of 83 days in the first case and 115 days in the second,—a mean difference of three months. That the figures show Baltimore to have a longer growing season than Easton or Pocomoke City is contrary to the evidence of the vegetation as repeatedly observed by the writer, and is doubtless due to the instruments at the Baltimore station being exposed in the midst of a large city. It is particularly noticeable that in the case of Pocomoke City the average date of the last occurrence of 40° is only 9 days after the average date of the last occurrence of 32°, while for Sunnyside the former date comes 50 days after the latter. This indicates a rapid oncoming of spring at Pocomoke City, with warm nights, and a long persistence of cool nights

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at Sunnyside. In the autumn, however, the average first occurrence of 32° at Sunnyside follows more rapidly on that of 40° (16 days) than it does at Pocomoke City (24 days).

In the first volume of the Publications of the Maryland Weather Service (p. 487) is given a map showing the date of the advent of spring throughout the state, which is reproduced herewith. The isochronals on this map indicate the average date of the permanent occurrence of a daily mean temperature of 44°. This temperature was taken by Mr. Walz, following Professor Harrington, on the as-

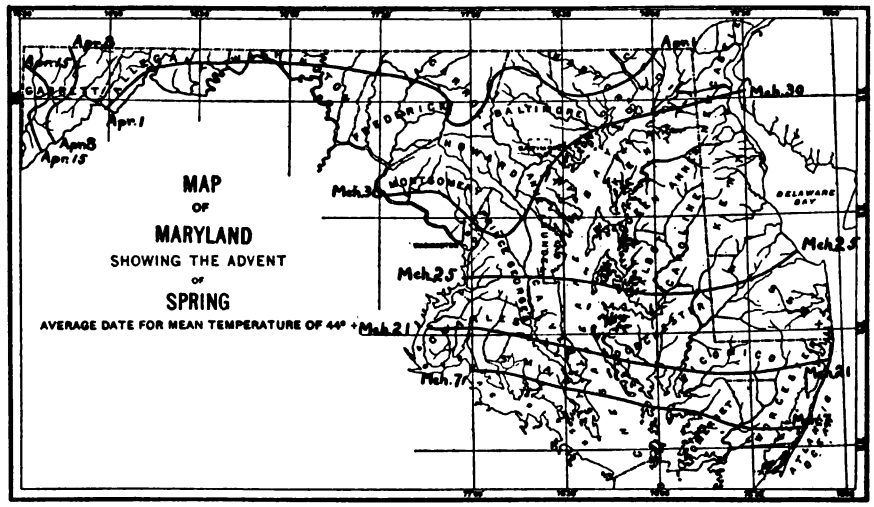

FIG. 2.—Map of Maryland Showing the Advent of Spring.

sumption of Hervé Magnon* based on a study of cereals, that plant protoplasm is inactive below a temperature of 42.8° Fahr. While there are many plants in the Maryland flora which would not be wakened to activity by a temperature one degree above 43° and very many others which would be wakened by temperatures lower than this, yet the isochronals for 44° may serve very well to indicate the character and rate of advance of other daily mean temperatures as

*Hervé Magnon, Des Conditions climatologiques des années 1869-1879 en Normandie, et leur influence sur la maturation des récoltes. Comptes Rendus, Vol. 89, 1879.

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well. Mr. Walz's map shows a difference of 39 days in the date of the advent of spring at Pocomoke City and Sunnyside, as contrasted with the difference of 30 days in the date of the last occurrence of 32°, and 71 days in the date of the last occurrence of 40°. While the difference between the date of arrival of spring at the extreme end of the state which is indicated in this map is approximately correct, the actual dates given are about 10 days too early, so far as concerns the greatest mass of unfolding of foliage in deciduous trees.

Humidity.—Data on atmospheric humidity are available only for

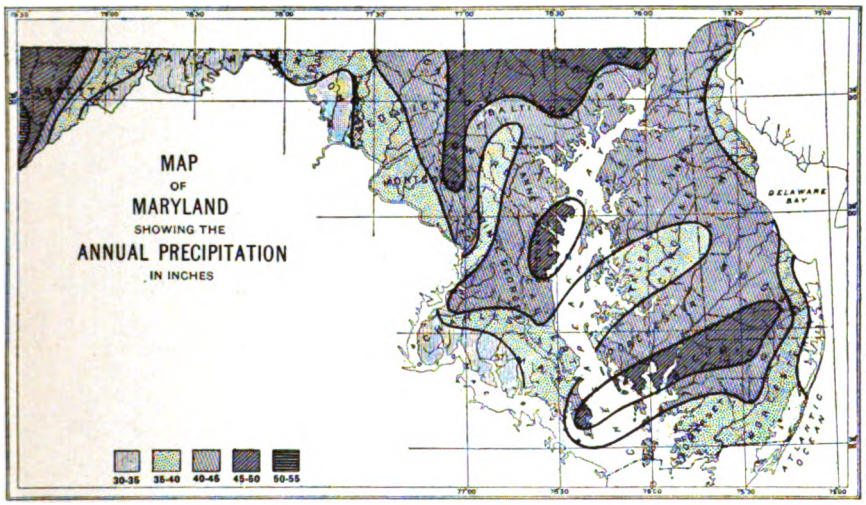

FIG. 3.—Map of Maryland Showing Annual Precipitation in Inches.

Baltimore, and would probably be found to differ for the other stations in very nearly the same proportion as does the rainfall. The data for Baltimore from 1893 to 1903 are as follows:

January, 68.3; February, 66.0; March, 66.8; April, 60.6; May, 65.1; June, 68.0; July, 67.1; August, 69.0; September, 70.4; October, 67.7; November, 66.3; December, 67.6; Year, 66.86%.

Rain-fall. — The uniformly favorable conditions of rain-fall throughout the state for the development of the highest types of plant-life make a comparison of the rain-fall data for the different stations selected of less importance than in the case of temperature.

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For the sake, however, of showing the absolute amounts of rain-fall and the number of rainy days these data are here given:

MONTHLY AND ANNUAL PRECIPITATION, 1893-1903.
(In inches.)

	Sunnyside.	Boettcherville.	Green Spring Furnace.	Frederick.	Baltimore.	Easton.	Pocomoke City.
Jan.	4.74	2.30	2.81	2.79	2.77	2.92	2.53
Feb.	5.14	3.04	3.34	3.80	3.93	4.28	3.83
March	5.37	3.51	3.49	3.54	3.15	3.39	3.71
April	4.44	3.05	2.68	3.07	3.35	3.04	3.50
May	5.19	4.05	3.72	2.94	3.58	3.20	3.00
June	5.31	3.78	3.45	3.65	2.97	3.67	2.90
July	5.58	3.39	3.74	3.70	3.93	4.42	3.90
Aug.	3.72	3.29	2.39	3.15	3.92	3.93	3.56
Sept.	3.20	2.53	2.45	2.82	3.86	3.03	3.56
Oct.	3.03	2.40	2.14	2.89	3.08	3.67	3.68
Nov.	4.41	2.24	2.66	2.71	2.77	2.77	2.68
Dec.	4.99	2.69	2.84	3.37	3.16	3.03	2.59
Year	55.12	36.27	35.71	41.43	40.47	41.35	39.44

AVERAGE NUMBER OF RAINY DAYS, 1893-1903.
(0.01 inch or more.)

	Sunnyside.	Boettcherville.	Green Spring Furnace.	Frederick.	Baltimore.	Easton.	Pocomoke City.
Jan.	17	6	8	8	11	8	8
Feb.	17	6	8	9	11	7	9
March	17	8	10	10	12	10	9
April	14	8	9	8	10	8	8
May	14	10	10	11	12	10	11
June	13	10	10	9	11	8	7
July	13	9	10	11	11	9	8
August	11	8	8	9	9	7	7
Sept.	9	5	6	7	8	6	7
Oct.	9	5	6	7	8	7	6
Nov.	13	6	8	9	9	7	7
Dec.	15	6	7	10	10	7	8
Year	162	87	100	108	122	94	95

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Wind.—Data on wind velocity are also available only for the Baltimore station, which may be well taken as representative of the conditions as respects this factor for the entire state. The following figures show the total daily wind movement (miles per day) for the different months of the year, being based on the records of the 30 years from 1873 to 1902:

January, 145; February, 162; March, 175; April, 166; May, 149; June, 142; July, 134; August, 122; September, 129; October, 137; November, 143; December, 142; Year, 145.

The most important influence of wind on vegetation lies in its acceleration of the rate of transpiration. This is an influence which is exerted upon all the plants of a given region, particularly those which are dominant in the various formations as contrasted with the sheltered subordinate vegetation. As a differential factor influencing the occurrence or exclusion of species the wind operates powerfully in situations where the soil moisture content is not high, as on the dunes and on rocky cliffs. Wind influences vegetation in quite another manner, in serving as one of the principal agencies in the distribution of small and buoyant seeds.

TOPOGRAPHY.

The topography of an area exerts an influence upon the character and local distribution of plant-life chiefly through its determination of the amount and character of the soil-water, to a less degree through its determination of exposure to insolation and wind. In upland localities away from the influence of streams the water table, or ground water level, is primarily determined by the elevation of the spot under consideration with respect to its immediate surroundings. In isolated gravel hills, such as Egg Hill or Foys Hill in Cecil County, the water table is deepest at the summit of the hill but approaches the surface as we descend, and at the base actually reaches the surface in the form of saturated areas of soil or running springs. It is, however, only in hills of homogeneous materials that such a simple condition exists. In hills bearing rock and merely a surface covering of soil the conditions of ground water movement and supply may be complicated in various ways through differences in the per-

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meability of the rock to water and through its inclination or dip. A highly important factor in determining the water content of soils is their physical texture, for this determines both their capacity to retain water which falls upon them as rain and to lift water by capillarity from the region of the ground water level. Coarse gravels and sands retain but a small percentage of the water which falls upon them while a high percentage is held by such soils as the clays and finer loams. Not only are clays and other fine soils capable of retaining water but also of lifting it by capillarity from lower levels as it is removed from the surface by evaporation or plant absorption. Gravels and coarse sands are incapable of thus lifting water by capillarity from the lower levels of the soil. The water table is not then of such great importance to plant-life in itself as it is in its office as a reservoir from which water may be supplied to the upper layers of the soil. The roots of upland plants are distributed through the soil chiefly in the region above the water table, where water is secured by the root hairs from the capillary films which surround the solid particles of the soil. Indeed, below the water table the soil is in a condition of saturation, which is hostile to the activity of the roots of upland plants through the exclusion of the air. In the beds of small valleys the water table often approaches the surface, being supplied by the movement of the soil-water from the neighboring hills, and in this manner springs arise and streams are fed. Along streams the height of the water table will depend upon the elevation of the banks. If these are low the earth immediately adjacent to the stream may be kept in a saturated condition or at least more moist than elsewhere. Percolation of stream water into the adjacent soil will account for the occurrence of trees along the streams of the semi-arid plains of western Kansas and Nebraska, where the soil moisture is elsewhere so low, because of the low rain-fall, as not to support tree growth. Broad level stretches adjoining streams may be so nearly of the same level with the stream as to be inundated at the time of high tides or freshets. Such levels are built up gradually by the deposition of silt at the time of their inundation. The soils of these flood plains may be of varying degrees of water content according to their elevation and the frequency of their inundation, but commonly vary from high percentages of water to saturation.

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We thus see that the topographic features of an area, taken together with the physical character of its soils, determine the varying amounts of water available to plants for absorption over such small areas as possess uniform conditions of temperature, light, atmospheric humidity and wind. The discrepancy which exists between the uniformity of the atmospheric conditions to which the aerial parts of all the plants of a given locality of such size as a county are subjected, and the diversity of the soil conditions over the same area, differing with topography, is at the basis of the differences in vegetation which are so manifest between nearby areas of different topographic character.

The science of physiography has for its subject matter not only the description of present topography but the study of the changes now going on in the topography. Such study enables the physiographer to unravel the past history of topographic features and to predict their fate. To the student of plant-life the most important phase of physiography is the relation of present topography to the physical conditions of the soil. However, it is seen to be true that the relation of vegetation to topography persists throughout changes which take place in the history of topographic features. It therefore follows that the vegetation of different topographic situations undergoes slow changes parallel to those in the topography and dependent upon them. In its relation to Ecological Plant Geography physiography is a study of the progressive changes in plant habitats, and is therefore of fundamental importance in interpreting the present changes in plant associations due to changing conditions, and in tracing the immediate past and future history of plant habitats.* The constant changes of topography which physiography recognises are distinguishable first as those which are operative in reducing the land masses of the earth toward sea-level, and second those which are tending to straighten the shore-line of the sea and its arms. Rainfall and stream action are the principal agents in the carrying on of the first of these processes, waves and along-shore currents the second; the first tend in their action toward a vertical

*Cowles, H. C., The Physiographic Ecology of Chicago and Vicinity; a study of the Origin, Development and Classification of Plant Societies. Botanical Gazette, Vol. XXXI., 1901, pp. 73-108 and 145-182.

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leveling of the land by the erosion of highlands and deposition in streams and bays, the second tend toward a horizontal straightening of the shore-line by the wearing away of capes and headlands and the filling in of the inlets.

The physiography of Maryland has received full treatment in an earlier volume of the publications of the Maryland Weather Service†. It becomes necessary here to present only a description of some of the features which are of principal importance in relation to the distribution of the vegetation.

The Coastal Zone; Eastern Shore District. — Many of the physical features of the Eastern Shore District are such as are characteristic of the Coastal Plain throughout the Atlantic seaboard. It is most level in the region of the Talbot terrace, the youngest of the Pleistocene formations, which has been described by Shattuck* as a subdivision of the Columbia formation of McGee. This terrace is most extensive in Worcester, Somerset, Dorchester and Talbot counties, and also forms a narrow strip bordering the shores of the northern counties (see map, Fig. 4.)† The upland rises from tide-level in some places so gradually as to give rise to extended areas of marshland, as in southern Dorchester County. In Drawbridge district of this county the marshes are 2½ miles in width and the margin of the upland just within them is from 2 to 3 ft. above tide-level, while the slope of the upland is about 1 ft. to the mile as measured northward to the higher part of the county. In Somerset County, to the west of Princess Anne, the outer end of the peninsula between Monie Bay and the Manokin River has a slope of 1⅔ ft. to the mile. In Somerset County an upland swamp lying on the divide between the Pocomoke and Manokin rivers, between

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†Abbe, Cleveland, Jr., A General Report on the Physiography of Maryland. Maryland Weather Service, Vol. I., 1899, pp. 39-216.

*Shattuck, George B., Pliocene and Pleistocene. Maryland Geological Survey, Baltimore, 1906.

†It is the judgment of the writer that the map by Shattuck greatly exaggerates the width of the Talbot formation along the upper waters of the Nanticoke and Choptank. Not having sufficiently complete data upon which to base a revision of those portions of the map, it is reproduced without change.

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FIG. 1.—VIEW SHOWING PURE STAND OF YOUNG LOBLOLLY PINE REFORESTING SANDY LOAM UPLAND OF TALBOT FORMATION, NEAR WAGRAM, WORCESTER COUNTY.

FIG. 2.—VIEW SHOWING SANDY FLOOD PLAIN ALONG MARSHY-HOPE CREEK WITH LOBLOLLY PINE, RED MAPLE, SOUR GUM, SWEET GUM, GREEN ASH AND MAGNOLIA, NEAR FEDERALSBURG, CAROLINE COUNTY.

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Princess Anne and Pocomoke City, is drained by a stream which has a fall of 3 ft. to the mile. On the oceanward side of Worcester County, in the neighborhood of Berlin, a few places in which there are slopes of 25 ft. to the mile exhibit the maximum for the Talbot terrace and are exceptional. Along the streams which cross the Talbot terrace there are in some places bluffs or steep banks from 8 to 15 ft. in height, as along the Pocomoke River between Pocomoke City and Rehoboth. Back of these banks the surface of the upland is nearly as level as it is back of the marshes of Dorchester County. The maximum elevations of the Talbot terrace where it abuts upon the older Wicomico terrace vary from 25 to 35 ft.

The Wicomico terrace occupies the inland portions of the Eastern Shore, forming the greater part of the area of Caroline, Queen Anne's and Kent counties. Owing to its greater elevation and longer exposure to sub-aerial erosion as contrasted with the Talbot terrace, it presents a gently undulating topography. The distinctness of the two formations may well be observed at a point about one mile east of Easton in Talbot County, and near Fairlee in Kent County. There are but few places where the estuaries have worn away the Talbot terrace and brought the Wicomico to the shore-line and such places are invariably occupied by bluffs 40 to 60 ft. in height, as at Betterton in Kent County. The Choptank River has also worn away the Talbot terrace at several places between Dover Bridge and Jamaica Point in Talbot County, where there are bluffs commonly about 20 ft. high. The portions of the Wicomico terrace lying in Wicomico, Caroline and Talbot counties have been eroded so as now to be completely drained by the streams which traverse them, while in the northern part of Queen Anne's County and the Eastern part of Kent the greater elevation of the upland together with the small drainage areas of the streams have combined to leave the upland relatively level and undrained. This gives rise to extensive swamps, such as are to be seen in the neighborhood of Barclay and Sudlerville in Queen Anne's County. It also gives rise to many swamps or ponds occupying small abrupt depressions without outlet, which represent original depressions in the floor of the Wicomico sea. The ponds which occupy the largest and deepest of

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these depressions are of interest as being the only natural ponds in the state. They are often intermittent and usually too small to have been noted on the topographic maps of the United States Geological Survey, indeed the depressions themselves often occur at such levels as not to be indicated by contour lines. A few of them are shown on the St. Michaels sheet in the neighborhood of Wye Mills. The slopes bordering the Sassafras and Bohemia rivers are rather steep, there being at many points a rise from tide-level to 60 ft. within half a mile. The greatest elevations of the Wicomico terrace on the untapped divides are commonly from 60 to 70 ft. in Queen Anne's County, and 80 to 85 ft. in Kent and southern Cecil Counties.

The portion of Cecil County lying between the Elk and North-East rivers, known as Elk Neck, is made up mainly of Cretaceous deposits and differs very much in its topography from the remainder of the Eastern Shore. The surface is rolling and rises in groups of rounded gravel hills several of which are over 300 ft. in elevation, the highest, Black Hill, being 311 ft.

The low elevation of the southern portion of the Eastern Shore has favored the development of areas, often many thousands of acres in extent, in which the soil is saturated. Along the estuaries these areas are subject to the influence of salt or brackish water and are covered by grassy vegetation devoid of trees,—*salt marshes.* Above the influence of brackish water the inundated lands along the streams are forested,—*river* or *stream swamps.* Lying well back from the streams on the poorly defined divides are areas subjected to inundation by rain in wet seasons and in which the soil is at all times saturated, whether or not there be standing water,—*upland swamps.**

The flatness of the upland renders natural surface drainage poor in all the more nearly level portions of the Eastern Shore, and on the areas of Elkton clay particularly the heavy rains of the

*The word *marsh* is used for a treeless plant community in a habitat with saturated soil, and the word *swamp* for such an area in which trees form the dominant vegetation. This is in accord with local usage on the Eastern Shore and elsewhere in the Coastal Plain.

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summer months may cause the ground of cultivated fields or woodland to lie for hours or even days in a submerged condition. This makes the ditching and draining of farm lands of great importance, but in these operations it is often difficult to secure sufficient fall in the drains to carry the water off. The total area of all classes of marsh and swamp land in the Eastern Shore counties is 276,736 acres, of which 128,960 acres are in Dorchester County.

Springs are of rare occurrence on the Eastern Shore. The smaller streams are fed chiefly by surface drainage and are therefore subject to considerable fluctuations in volume or are intermittent. The writer has been told that even as considerable a stream as the Pocomoke River suffers a noticeable shrinkage of volume during periods of several weeks with low rain-fall. All of the rivers save the Elk and the North-East rise in the Coastal Plain, and the currents in them are extremely sluggish. The mouths are in all cases drowned to form broad estuaries tributary to the Chesapeake Bay. The tide in the Chesapeake varies from a range of 4 ft. in the Patuxent River to 1.4 ft. at Sharp's Island. In all the longer rivers the rise and fall of the tide in the estuary at the mouth causes a rise and fall of the waters of the upper part of the stream. In the Pocomoke River at Snow Hill there is a mean tide of 2½ ft., although it is 18 miles above the uppermost part of the river in which the water is brackish. The ebb and flow to which these waters are subjected co-operates with the gentleness of the fall of the stream bed to render them sluggish. In the Pocomoke and Nanticoke rivers the water has the rich amber hue characteristic of so many coastal rivers that are bordered by cypress or white cedar swamps.

The Coastal Zone; Western Shore District.—The Coastal Zone of the Western Shore comprises all of St. Mary's, Charles, Calvert, Prince George's and Anne Arundel counties and portions of Baltimore and Harford counties, being bounded to the west and north by the "Fall-line." The topography of the Coastal Plain of the Western Shore may be stated in general terms to be a late initial stage in the dissection of a peneplain. The maximum elevation varies from 60 ft. in Harford County and 250 ft. in Anne Arundel County to as much as 292 ft. in portions of Prince George's County. The

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Coastal Plain portions of Harford and Baltimore counties and a few places on the shore of Anne Arundel County are relatively level at elevations of 20 ft. or less, being in the Talbot formation; so also are portions of the interior in Charles and Prince George's counties at elevations of 100 to 120 ft., being in the Lafayette formation. It is in the southernmost part of the Chesapeake-Potomac peninsula, and particularly in the neighborhood of the estuaries that the topography is most sharply dissected. In almost all localities about the heads of estuaries there is a sharp rise from tide-level to elevations of 100 to 140 ft., while along the Bay side of Calvert County there is a series of bluffs 60 to 80 ft. in height. The initial state of the topography is revealed in the flat divides which lie between the heads of the smaller streams, as in the neighborhood of Brandywine in Prince George's County.

The larger streams which traverse this area, the Patuxent, Patapsco and Gunpowder, rise in the Piedmont, while a number of the smaller streams, the Wicomico, the Severn and the Magothy, rise in the Coastal Plain. All of the larger streams merge into estuaries, which are in general shorter and more abrupt in their termination than those of the Eastern Shore. Consequent upon the character of the topography there is a much less development of marshes and swamps along the estuaries and streams than is the case on the Eastern Shore. Marshes are most extensive about Spesutie Island and southward along the Bay shore of Harford County. While there are no upland swamps the Western Shore district has the only typical peat bogs in the state outside the Mountain Zone.

The Midland Zone; Lower Midland District.—The Lower Midland District comprises the northern half of Cecil County, the greater parts of Harford, Baltimore, Howard and Montgomery counties, and a portion of Carroll. It is underlaid by Crystalline rocks, mostly of a character very resistant to weathering. The topography of the region may be stated in general terms as being that of a maturely dissected peneplain. The gently rolling plateaus descend to the streams at first gently, then abruptly, there often being outcrops of rock adjacent to the streams. The maximum ele-

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vations in the Lower Midland range from 480 ft. for Cecil County near Rising Sun, to 740 ft. for Harford County near Jarrettsville, and 850 ft. for Montgomery County near Damascus. The general topography is very uniform throughout the district, and lakes and ponds are absent. Springs are abundant and constant streams of varying size dissect every corner of the district. Greater or smaller flood-plains have been built up along all of the streams, and in those that are least elevated above the mean level of their stream their vegetation is swamp forest. Marshes and other natural grassland formations are absent. The Susquehanna and Potomac are the only streams rising above the Lower Midland and traversing it. The Gunpowder, Patapsco and Patuxent rise in it.

The Midland Zone; Upper Midland District.—The Upper Midland District embraces portions of Carroll and Montgomery counties, the whole of Frederick and Washington counties, and the eastern portion of Allegany County. It is bounded on the east by the summit of Parr's Ridge and on the west approximately by the contour of 1500 ft. altitude.

Parr's Ridge is an ill-defined series of elevations ranging from 850 to 900 ft. in height. Just west of its southern termination stands the isolated mountain Sugar Loaf, of 1250 ft. altitude. These elevations are separated by the relatively level Frederick Valley from the Catoctin Ridge and the Blue Ridge, which traverse Frederick County in a nearly NNE-SSW direction. The floor of the Frederick Valley is from 250 to 500 ft. in elevation, and the highest points of the Catoctin and Blue Ridges reach 1500 to 2000 ft. Extending west from the Blue Ridge to North Mountain is the Hagerstown Valley, 20 miles in width. From North Mountain to the Western edge of the Piedmont there is a continuous series of narrow valleys and steep ridges,—Tonoloway Ridge, Town Hill, Polish Mountain, Warrior Mountain, and other shorter ridges. The floors of these valleys range from 500 to 800 ft. in elevation, the ridges from 1300 to 2000 ft. The Upper Midland presents a final stage of physiographic development, the result of which has been determined by the mineralogical character of the rocks of the district, each of the great valleys, Frederick Valley and Hagerstown

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Valley, being underlaid by limestone, the mountain ridges by a variety of non-calcareous rocks. The mountain slopes are of moderate steepness with thin soils, and in many localities with copious rock fragments or boulders at the surface. As in the Lower Midland, springs and constant streams are numerous but swamps are confined to low flood-plains or mountain "coves" with gentle slope, and ponds are absent. The district is drained by the Potomac and by its tributaries the Monocacy, Catoctin, Antietam, Conococheague and Town creeks. The tributaries rise either in Maryland or a few miles north in Pennsylvania in each case flowing entirely in valleys of the same mineralogical character throughout.

The Mountain Zone.—The Mountain Zone embraces the valley of Georges Creek in Allegany County and nearly the whole of Garrett County, and is chiefly characterized by the fact that it lies entirely above 1500 ft. elevation.

The eastern edge of the Mountain Zone is formed by Wills Mountain, and by Dans Mountain, nearly level ridges, the former of which varies from 1600 to 1800 ft. in elevation, the latter from 2600 to 2882 ft. at its highest point, Dans Rock. Parallel to these ridges and traversing the eastern edge of Garrett County are the Big Savage and Great Backbone ridges, the highest mountains in Maryland, ranging in elevation from 2900 to nearly 3200 ft. at many points and reaching near Table Rock 3340 ft., the highest elevation in the state. The valley between Dans Mountain and Big Savage is about 8 miles wide and is drained by Georges Creek, Braddock Run and Jennings Run. The valley falls below 1500 ft. only near the lower courses of the principal streams. The eastern slopes of the Great Backbone Ridge are drained by the Potomac and, as it is true of all the mountain ridges above mentioned, the eastern slope is much steeper than the western. To the west of Big Savage Mountain, Garrett County is traversed in a NE-SW direction by successive ridges,—Meadow Mountain, Negro Mountain and Winding Ridge, the maximum elevations of which range from 2700 to 3000 ft. West of Great Backbone Mountain is a relatively level plateau about 5 miles wide, of 2400 to 2500 ft. elevation, bounded on the west by ill-defined ranges of hills of 2500 to 2900 ft. The

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physiography of the Mountain Zone is in the sequential stage throughout, and even in the narrowest and steepest valleys rock outcrops are rare and of limited extent. The valley between Big Savage and Meadow Mountains is drained by the Savage River, which flows to the Potomac through the narrow valley which separates Big Savage and Backbone Mountains. The upper drainage basin of the Savage has the most rugged and precipitous topography of any portion of Maryland, many slopes being at the grade of 1200 ft. to the mile and exceptional ones 2500 ft. to the mile. To the west of Meadow and Great Backbone Mountains the Mountain Zone is drained by the Castleman and Youghiogheny rivers, which are in the drainage basin of the Mississippi.

Peculiar to the Mountain Zone are the Swamps which are found along the upper waters of many streams draining narrow mountain valleys in which the longitudinal slope is not great. There is such a swamp two miles south of Finzel in Garrett County, and another at the head of Pine Swamp Run about four miles north-west of Barton, and more extensive ones occur at Cranesville and Thayerville. In the central plateau of Garrett County there are considerable areas of alluvial bottom land which have been built up by the deposition of eroded material in these swamps. The bottom lands are known locally as "glades."

Shore-Line Topography.—Constant changes are taking place in the outline of the coast of the Ocean and Chesapeake Bay which are due to the destructive action of waves and tidal currents in wearing away the shore-line and the constructive action of the filling of inlets and marshes by the depositing of the eroded material. The shore-line topography of Chesapeake Bay is in a sequential stage, having undergone considerable changes since the Talbot uplift, and being still far from a condition approaching stabilization. The destructive phase of change in shore-line topography is of little interest in its relation to vegetation, as it merely destroys Upland forest or Marsh. The constructive phases, however, result ultimately in the presenting of new habitats for occupation by plants, in which the physical conditions are usually of a marked character, so as to be hostile to the generality of Upland species. Rapid changes

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in the conditions, due to physical agencies and to the vegetation itself result in a gradual replacing of the earliest plant covering by successive different ones. As respects their physical conditions important to plant life, new habitats due to shore-line changes fall into two classes, *a*—those arising from the deposition of fine material in the shallow water of inlets and coves, *b*—those arising from the building up of reefs or bars of coarse soil, which takes place only on the shores of larger bodies of water where wave or tidal action is vigorous. The first of these classes embraces salt or brackish marshes, the second the fringing-reef of the ocean front, and hooks, spits and bars such as may be found at Roaring Point in the Nanticoke River, at Castle Haven in the Choptank River, and at Lloyds Creek in the Sassafras River. The character of the material of which new features consist and the level to which they are built above tide determines their soil-water conditions, which in turn determine the occurrence of salt marsh, brackish marsh, strand or dune vegetation. A secondary result of deposit along shore-lines is the formation of bars which cut off small inlets from the main body of water as has occurred at a number of localities along the Chesapeake Bay in Kent and Anne Arundel counties. The conditions become gradually changed from salt to fresh in these so-called "relic ponds."

MINERALOGY AND SOILS.

The relation in which the soil stands to plants is that of a storehouse of water and raw food materials. This causes all of the characteristics of the soil which have to do with the presence and availability of both the water and its dissolved substances to be of great importance in the physiology of the plants occupying the soil, and the differences in the physiological character of different plants causes these soil conditions to play a very important role in sorting the species which make up the flora of a given area. In other words, soil conditions are responsible for the distribution of plants in small areas with uniform climate. The fact has already been pointed out that the topography often operates in determining the water content of soils, yet it is only one of many factors which lie at the base of the characteristics of the soil. The direct importance of soils to

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FIG. 1.—VIEW SHOWING FLOOD-PLAIN FOREST ALONG THE UPPER WATERS OF THE WICOMICO RIVER, FOUR MILES NORTH OF SALISBURY, WICOMICO COUNTY.

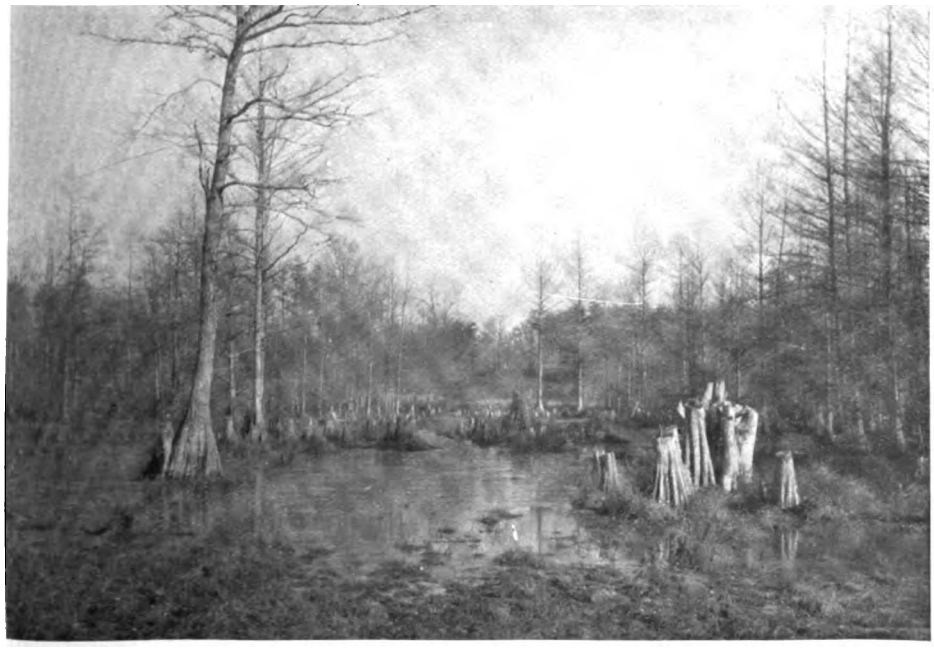

FIG. 2.—VIEW SHOWING RIVER SWAMP WITH A NEARLY PURE STAND OF SECOND GROWTH BALD CYPRESS, BATTLE CREEK, CALVERT COUNTY.

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plants then, consists first in the soluble food substances which they contain, and second in the manner in which they make available to plants the water which climate and topography bring within the sphere of control of the soil itself.

The principal bulk of soils is made up of rock particles rich in difficultly soluble salts of aluminum and silicon. It is to the insolubility of these salts, in fact, that their predominance is due. Soils owe their origin to the weathering of rocks and to the gradual disintegration and pulverizing of the rock fragments by the action of frost, rain, etc. The rapidity with which a particular sort of rock may be weathered to soil, and the degree of fineness to which its ultimate particles will be reduced depends upon the mineralogical character of the rock. In regions where rocks have been exposed to the atmosphere for a very long time we will find overlying each rock formation the particular sort of soil to which it gives rise, as is the case throughout almost the whole of Maryland to the north and west of the "Fall-line." In the Coastal Plain the soils are derived from materials which have been transported by streams from the eroding upland and laid down in the floor of a shallow ocean. These facts point to a distribution of soils in the Midland and Mountain Zones of Maryland which is closely parallel to the distribution of the various rock formations. The fact that the soils became inhabited by plants very early in their origin is not only important in its relation to their further weathering but also to the admixture with the rock particles of minute fragments of organic matter,—the humus. The interstices between the particles of rock and humus may be completely filled with air or completely filled with water. Under average natural conditions in upland soils the interstices are partly filled with water, which adheres by capillary attraction to the surfaces of the rock particles or accumulates in the acute angles formed by the contact of adjacent particles or is held by imbibition in the humus particles.

In a review of the characteristics of the soil it is necessary to distinguish between those that are chemical and those that are physical, between such features on the one hand as the chemical nature of the rock particles or the amount and state of the humus, or, on the other

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hand, the size of the rock particles. The constant contact of water with the rock particles and humus causes a continued solution of their component substances, and all the importance of the chemical character of the rock particles lies in the substances which they yield into solution and thus make available to plants. The soil-water is, then, a very dilute solution in proportions varying with their solubility of all the substances with which it has come into contact in the soil. The existence in the soil-water of salts containing nitrogen, phosphorus, sulphur, potassium, magnesium, calcium and iron is indispensable to the nourishment of all green plants. Other elements may be taken up by plants but are used by them only as accessory and dispensable food substances. It is significant that the chemical character of most rocks is so complex that there are only rare cases in which soils lack any of the elements necessary to plant nutrition. It is true that some of the elements are present in soils only in very small quantities, as phosphorus, and may be drawn upon by plants more rapidly than they become available, or may be leached away by the action of the rain. The nitrogen demanded by plants can be used only in the form of nitrates which are very readily soluble salts. The nitrates of the soil are constantly being replenished by the action of bacteria upon the humus, and may be wanting either by the lack of humus or of sufficient aeration of the soil for the activity of the nitrifying bacteria, or by the too rapid leaching away of the products of bacterial action.

It is evident, therefore, that unfavorable conditions for plant growth may arise through the insufficiency in the soil-water of some of the less abundant or more readily leached salts. Equally unfavorable conditions may arise through the accumulation of percentages of any of the salts which are so high as to become toxic to roots. This is the condition in salt marshes and in the alkali soils of the western United States, and accounts for the absence of ordinary plants from these habitats and their peopling with specialized salt-resisting plants. The fact that a given percentage of salt in the soil-water is not equally toxic to all plants causes a sorting or elimination of species, which may be observed both in the case of salt marshes and in the serpentine barrens, where the excess of mag-

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nesium plays a role analagous to that of sodium chloride in the salt marsh.

Recent work in the Bureau of Soils of the Agricultural Department has shown that toxic substances may be present in soils as a result of their excretion by the roots of plants. They are relatively complex organic substances and each of them exerts its toxic effect only upon the same species of plant as that by which it was excreted. Much of the value of the practice of crop rotation would appear to be due to the accumulation of these toxic substances rather than to the exhaustion of any of the food elements of the soil.*

The size of the rock particles of the soil and the proportion of humus material that it contains are the only physical characteristics which are of universal importance. The fact that the physical texture of soils determines so completely the control which they exert over the supplies of water furnished them by rain-fall or underground seepage, makes very important a knowledge of the behavior of soils of different texture with respect to the receiving, retention and lifting of water. The gravels and sands are in all respects the reverse of the finer loams and clays in their relation to the soil-water. The former are highly receptive to the water which falls upon them as rain, while clays may be so unreceptive as to often "puddle" at the surface while their lower layers are not yet saturated. The capacity of the gravels and sands to retain water against the pull of gravity is very poor, while clay soils hold water so retentively that it may even be impossible for plants to secure it from moist clay owing to the strong retention which prevents the movement of water toward the root hairs of plants to replace that which has been absorbed. With respect to the capacity of the two classes of soils to lift water, the sands are capable of doing so poorly and only to inconsiderable heights, while clays lift slowly but to great distances. The loams such as form the bulk of the surface soil of agricultural lands are intermediate in character between the sands and clays, and present, therefore, the optimum soil conditions for plants,—a moderate amount of water received with ease and re-

*For the original papers on root excretions see Bulletins 28, 36, 40 and 47 of the Bureau of Soils.

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tained well but not too forcefully. The humus material of soils is sponge-like and serves therefore to improve the water-holding capacity of sands, at the same time that it may also improve the texture of clays by increasing their aeration. The amount of air contained by soils is the reciprocal of the water content, so it follows that the aeration of sands is excellent while that of clays is poor.

The relative importance of the chemical and physical features of the soil in determining the character and distribution of the vegetation is a matter that does not admit of an absolute answer. That the soil should contain the necessary elements of plant food, and in available form, and not in such abundance as to be toxic is of paramount importance. That the physical character of the soil should be such as to make available to the plant constant supplies of water, without at the same time depriving the root system of the necessary air for respiration is likewise of fundamental importance. As a differential factor in the distribution of vegetation, however, the physical character of soils plays a more important role than the chemical.

Not only does the chemical nature of the rock underlying residual soils determine the chemical character of the soil-water, but its mineralogical nature determines primarily the physical character of the soil. A homogeneous rock-exposure subjected to weathering becomes reduced to a soil of homogeneous texture. Gabbro, for example, weathers to a clay, limestone to clay, and sandstone to sand, while a rock composed of several mixed minerals, as granite, usually gives rise to loam. It thus comes about that there is a close correspondence between the distribution of soils of different physical texture and the underlying rock formations in the part of Maryland above the "Fall-line." The careful mapping of the geological formations of the state by the Maryland Geological Survey, together with the soil surveys which have been made in seven counties* by the Bureau of Soils, serve to give a definite basis for a study of the relation of vegetation to the physical character of the soil. The soil types described by the Bureau of Soils are distinguished on their

*The counties in which soil surveys have been made are: Worcester, Kent, Cecil, Harford, Prince George's, Calvert and St. Mary's.

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physical texture and the nature of the subsoil. A total of 24 soil types have been described in the counties mapped. The differences between some of the types are inconsiderable and are without apparent influence as differential factors in the distribution of vegetation.

Coastal Zone, Eastern Shore District.—On the Eastern Shore on the Talbot terrace the predominant soils are sands, sandy loams and clays. Through Worcester and Wicomico counties the sands and sandy-loams predominate over the clays while in Somerset, Dorchester, Talbot and Queen Anne's counties the reverse is the case. The clay types are but two—Elkton clay and Galveston clay. The latter occurs only in tidal swamps, the former in the upland in situations where it was laid down in Talbot time in the same manner in which the Galveston clay is being laid down today. The Meadow of the Soil Survey is closely similar to the Elkton clay and identical in the character of its vegetation. The Wicomico formation predominates in sands, sandy loams and loams, with small areas of gravel along the inner edge of the Talbot terrace in the southern and central counties and extensive areas of it in portions of Cecil County. Sassafras loam and Norfolk sand are the predominant soils of the Wicomico terrace in Kent and Cecil counties.

Coastal Zone, Western Shore District.—In this District the distribution of the soils is very complex, which is to be accounted for by the fact that the geological history of the region has been the successive laying down under water of strata of different character, the elevation of the whole mass, and the subsequent carving of the raised mass by erosion in such a manner as to expose the same soil formations at the same elevation in every drainage basin. This area has a narrow strip of gravel along the ancient Talbot beach, as on the Eastern Shore, while in a belt of country about 5 to 10 miles broad along the "Fall-line" there are extensive areas of gravel continuous with those on Elk Neck and the "Fall-line" portion of Cecil County. Sands, sandy loams and loams are the chief soils of the land lying away from the "Fall-line," the two former in several types—Windsor sand, Norfolk sand, Collington sandy loam—being characteristic of the level interior of Prince George's and Anne Arundel counties. Susquehanna clay is closely associated with Sus-

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quehanna gravel along the "Fall-line" belt just alluded to. On the Talbot terrace, in the localities along the Chesapeake where it is widest, Elkton clay and Meadow occur, along with Sassafras loam or Sassafras sandy loam.

Midland Zone, Lower Midland District.—This district is underlaid by igneous and metamorphic rocks of Archean or early Paleozoic age—granite, gneiss, mica-schist, gabbro, marble and serpentine. The soils are loams and clays conforming with the rocks in distribution and having, in part, chemical as well as physical features of importance to vegetation. The granite, gneiss and mica-schist have given rise to the Cecil loam and the Cecil mica-loam, the slate to Cardiff slate loam, the gabbro to Cecil clay and the serpentine to Conowingo clay. The soil of the most marked chemical character is the Conowingo clay. The peculiar vegetation of this soil has long given the areas the name of Serpentine Barrens. Their peculiarity consists in the absence of the greater part of the flora of neighboring soils, the abundance of some plants uncommon elsewhere and the sole occurrence of at least two species of herbaceous plants. These peculiarities of flora are to be ascribed to the toxic effect of the high content of the soil water in magnesium, together with the absence of lime and potash. The Gabbro also presents a few peculiarities of vegetation, chiefly the rarity of several species of Ericaceae and certain forest trees. This may be attributable in part to the high content of the mineral constituents of the soil in magnesium, although the presence of lime makes this somewhat improbable.* The physical character of the soil is a much more obvious cause for the absence of such sand-loving plants as the heaths alluded to.

Midland Zone, Upper Midland District.—The Upper Midland District possesses a wide diversity of underlying rocks ranging in geological age from Archaean to Triassic, and the soils follow them closely in distribution. No soil surveys have been made in this District nor in the Mountain Zone, so their soils are known technically only through surveys made in other states on the same geological

*The influence of lime in counteracting the toxic effect of magnesium has been shown by May, Bulletin 1, Bureau of Plant Industry.

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formations.* Clays are widely distributed over the region of acid and basic volcanics in central Carroll, eastern Frederick and western Montgomery counties, and also on the red shales of the Newark formation in western Carroll, central Frederick and western Montgomery counties. The former of these areas is made up, however, of clay-loams and loams (Cecil loam), which are frequently full of small rock fragments; the latter of the areas also embraces considerable clay loam and sandy loam. The most extensive clay areas are in the Frederick and Hagerstown valleys, overlying the Shenandoah limestone, where a loam (Hagerstown loam) also occurs. Through the Catoctin and Blue Ridges many soil types are found—clays (the Porters clay), loams (Porters stony loam, Penn loam) and sandy loams. West of North Mountain shales and sandstones are the predominant rocks, and loams or clay loams together with sands are the commonest soil types. There are restricted outcrops of limestone in the Niagara and the Jennings-Romney formations, yielding local areas of heavy clay. The shale soils are invariably thin and filled with small rock fragments, which renders them unfavorable for the development of the highest type of forest.

Mountain Zone.—The soils of the Mountain Zone are similar in their general character to those of the Upper Midland District west of North Mountain. The shales and sandstones of the Jennings, Hampshire and Conemaugh formations occupy a large part of the area of the Zone and have given rise to loams, sandy loams and sands. The Mauch Chunk and Allegheny formations are more restricted in area, but similar in the character of the soils to which they have given origin. Small areas of limestone in the Greenbrier and Conemaugh have weathered to clay soils. The Pocono and Pottsville formations are of sandstone and have given rise to sandy-loams and sands.

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*Among these are the surveys of Adams, Lancaster and Lebanon counties, Pennsylvania.

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PART II

THE FLORISTIC PLANT GEOGRAPHY OF MARYLAND

BY

FORREST SHREVE

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THE FLORISTIC PLANT GEOGRAPHY OF MARYLAND

BY

FORREST SHREVE

Introductory.

There has never been an attempt made at a complete enumeration of the flora of Maryland, although the state lies in a region in which the collection and study of plants has been pursued since the middle of the Eighteenth Century. The early work of the Bartrams, of Pursh, Nuttall, Muhlenberg, Darlington and Rafinesque was carried on either partly in Maryland or so near its borders as to be applicable to its flora.

The earliest list of Maryland plants is that published in 1837 by William E. A. Aikin, M. D., entitled "A Catalogue of Phaenogamous Plants and Ferns, Native or Naturalized, Growing in the Vicinity of Baltimore, Maryland."* This catalogue lists 1063 species, and is based on work done in 1834 and 1835 in Frederick County and in 1836 in the vicinity of Baltimore. The author says, "The low grounds of the Eastern Shore and the mountain ridges of Allegany County† have been scarcely examined by the botanist." Seven years earlier than Aikin's List appeared the Prodromus of the Flora Columbiana compiled by J. A. Brereton, M. D., and arranged according to the Linnaean System. This was the first of a number of lists of the plants of the District of Columbia, none of which have been strictly confined in their area to the District.

In 1876 appeared the "Flora Columbiana," which embodied the results of the Potomac-Side Naturalists' Club, under the guiding

*For exact citations of literature see the List of Literature at the end of this chapter.

†Which then comprised the present counties of Allegany and Garrett.

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spirit of George Vasey, then Botanist of the United States Department of Agriculture. This publication lists 1154 species of Flowering Plants and 37 of Ferns and Fern-allies. The continued activity of botanists connected with the Agricultural Department at Washington led to the publication by Lester F. Ward in 1881 of his "Guide to the Flora of Washington and Vicinity," which embraces in its field all the country within a twenty-mile radius of the capitol, thereby including considerable portions of Montgomery and Prince George's counties, and small portions of three other counties of Maryland. This work lists 1211 species of Flowering Plants and 42 of Ferns and Fern-allies, as well as a few Mosses and Liverworts. Six lists of additions to Ward's Flora have been published from time to time since 1881. In 1888 Basil Sollers published a "Check-list of Plants Compiled for the Vicinity of Baltimore." The area comprised was a square the side of which was twenty-five miles in length and the centre the City Hall of Baltimore. Sollers' List was compiled to include the species listed by Aikin (there reduced to 1009) and those in Ward's Flora and the first two lists of additions thereto, together with additions made by himself, Dr. Bolling W. Barton and George L. Smith. The total number of species thus listed is 1559 of Flowering Plants and 50 of Ferns and Fern-allies. William M. Canby, of Wilmington, Delaware, did considerable collecting in the southern Eastern Shore, between 1865 and 1875, and to him we owe the discovery there of *Isoetes saccharata* and *Hydrocotyle canbyi*. Howard Shriver, of Cumberland, was for many years interested in a study of the flora of the vicinity of Cumberland, work which has been continued there since his death by Prof. George M. Perdew, who has kindly placed their local collection in the hands of the author. Other contributions to the knowledge of the flora of Maryland are mentioned in the List of Literature at the close of this chapter.

In the Plant List which forms Part VII of this volume 1378 species of Flowering Plants and 59 species of Ferns and Fern-allies have been collected or observed.* The number of species which will be

*It is of interest to note in comparison that the number of species of the same groups listed in Millspaugh's Flora of West Virginia is 1309; in Porter's Flora of Pennsylvania, 2201; and in Mohr's Plant Life of Alabama, 2476.

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found to grow within the borders of the state when its flora shall have been thoroughly exploited, will probably be between 1800 and 1900. The lack of a reasonably complete Flora of Maryland renders it impossible to work out in detail the features of the distribution of plants within the state and the relationships of the flora to that of other regions. The matter in hand is, however, at least sufficient to permit a review of some of the main floristic features.

The great bulk of the flora is of wide distribution throughout the Northeastern United States, or indeed throughout the whole of eastern North America. The central counties in particular are rich in species which range from Ontario or the New England States to Michigan or Minnesota, and south to Georgia and Alabama. In addition to this groundwork of plants of wide distribution, the coastal section of the state is found to be rich in species the principal range of which is to the south, with their northern limit either in Maryland or in the coastal section of New Jersey or Long Island. In the higher mountains, on the other hand, there is a considerable element the chief range of which is to the north or throughout the Alleghany Mountains. The salt and brackish habitats about the Chesapeake Bay and the Ocean front afford congenial conditions for the growth of salt-loving, or halophytic, plants, which are a small but interesting element of the flora. Intermingled with the native plants throughout the state is a large number of introduced foreign or western plants, chiefly weeds, which form an element of the flora which is constantly being augmented.

The occurrence of the southern floral element in the coastal portion of Maryland, and of the northern element in the higher mountains suggests the subdivision of the state into three Zones in accordance therewith. The fact that many of the southern species are found throughout the Coastal Plain in Maryland suggests the "Fall-Line" as the most natural boundary of the *Coastal Zone*. That portion of the state lying between the "Fall-Line" and the higher mountains will here be designated as the *Midland Zone*. The contour line of 1500 feet elevation, running along the Eastern slopes of Wills, and Great Backbone Mountains forms the approximate eastern limit of the region characterized by the northern element, which will be designated as the *Mountain Zone*. These zones apparently correspond

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respectively to the Alleghanian, Carolinian and Louisianian Zones of Verrill and to the Transition, Upper Austral and Lower Austral Life-zones of Merriam.

Not only are there species present in the Coastal Zone and in the Mountain Zone which are absent from the Midland Zone, but there are species present in the Mountain and Midland Zones which are absent from the Coastal Zone and others present in the Coastal and Midland Zones which are absent from the Mountain Zone. While these Zones are based primarily on floristic distinctness, there are nevertheless ecological features characteristic of each, of which mention will be made later.

The species which are found only in the Coastal Zone in Maryland are the following, halophytes being omitted:

Woodwardia virginica
Woodwardia areolata
Lycopodium inundatum
Pinus taeda
Taxodium distichum
Chamaecyparis thyoides
Typha angustifolia
Sagittaria lancifolia
Sagittaria subulata
Erianthus compactus
Panicum digitarioides
Zizania aquatica
Uniola laxa
Arundinaria tecta
Cyperus pseudovegetus
Cyperus retrofractus
Cyperus cylindricus
Cyperus grayi
Kyllinga pumila
Scirpus cylindricus
Scirpus fluviatilis
Fuirena squarrosa var. *hispida*
Rynchospora corniculata

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FIG. 1—VIEW SHOWING TRANSITION FROM MARSH TO RIVER SWAMP ON THE POCOMOKE RIVER JUST ABOVE REHOBETH, SOMERSET COUNTY.

FIG. 2.—VIEW SHOWING MARGINAL ZONE OF MARSH VEGETATION ALONG OUTER EDGE OF RIVER SWAMP WITH ROSE MALLOW, WAX MYRTLE, MAGNOLIA AND LANCE-LEAVED ARROW-HEAD, POCOMOKE RIVER, TWO MILES BELOW POCOMOKE CITY, WORCESTER COUNTY.

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Rynchospora gracilenta
Cladium mariscoides
Carex vestita
Eriocaulon decangulare
Commelina hirtella
Juncus repens
Smilax laurifolia
Smilax walteri
Myrica cerifera
Myrica carolinensis
Quercus digitata
Quercus nigra
Quercus phellos
Magnolia virginiana
Itea virginica
Liquidambar styraciflua
Rubus cuneifolius
Cracca spicata
Bradburya virginiana
Aeschynomene virginica
Rhynchosia erecta
Polygala lutea
Crotonopsis linearis
Euphorbia ipecacuanhae
Ilex opaca (as a tree)
Ilex glabra
Vitis rotundifolia
Ascyrum stans
Triadenum petiolatum
Hudsonia tomentosa
Ludwigia sphaerocarpa
Ludwigia linearis
Jussiaea decurrens
Proserpinaca palustris
Aralia spinosa
Hydrocotyle canbyi
Hydrocotyle verticillata

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Hydrocotyle ranunculoides
Centella asiatica
Nyssa biflora
Clethra alnifolia
Kalmia angustifolia
Leucothoe racemosa
Pieris mariana
Symplocos tinctoria (fide Rusby)
Polypremum procumbens
Sabbatia dodecandra
Limnanthemum aquaticum
Asclepias lanceolata
Koellia aristata
Vincetoxicum hirsutum
Gratiola pilosa
Utricularia juncea
Utricularia clandestina
Utricularia fibrosa
Bignonia crucigera
Tecoma radicans
Diodia virginiana
Galium hispidulum
Viburnum venosum
Viburnum nudum
Lonicera sempervirens
Elephantopus nudatus
Sclerolepis uniflora
Eupatorium hyssopifolium
Heterotheca subaxillaris
Chrysopsis graminifolia
Solidago odora
Aster spectabilia
Helianthus angustifolius
Senecio tomentosus

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The species which are found only in the Mountain Zone are the following:

Larix laricina
Picea mariana
Taxus minor
Clintonia umbellulata
Disporum lanuginosum
Streptopus roseus
Betula lutea
Alnus incana
Coptis trifolia
Cimicifuga americana
Aconitum uncinatum
Anemone trifolia
Hepatica acuta
Bicuculla eximia
Saxifraga micranthidifolia
Dalibarda repens
Waldsteinia fragarioides
Sorbus americana
Acer pennsylvanicum
Acer spicatum
Viola rotundifolia
Cornus canadensis
Azalea lutea
Menziesia pilosa
Gentiana linearis
Viburnum alnifolium
Lonicera ciliata
Solidago monticola
Aster acuminatus

The species found throughout the Mountain and Midland Zones which are absent from the Coastal Zone are the following:

Camptosorus rhizophyllus
Asplenium montanum

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Osmunda claytoniana
Pellaea atropurpurea
Cheilanthes lanosa
Selaginella rupestris
Pinus strobus
Unifolium canadense
Trillium spp.
Orchis spectabilis
Cypripedium parviflorum
Betula lenta
Magnolia tripetala
Caltha palustris
Actaea alba
Anemone virginiana
Caulophyllum thalictroides
Chelidonium majus
Bicuculla cucullaria
Capnoides sempervirens
Sedum telephioides
Sedum ternatum
Mitella diphylla
Ribes spp.
Opulaster opulifolius
Porteranthus trifoliatus
Astragalus carolinianus
Ptelea trifoliata
Euphorbia commutata
Staphylea trifolia
Cubelium concolor
Dirca palustris
Panax quinquefolium
Panax trifolium
Cicuta bulbifera
Rhododendron maximum
Obolaria virginica
Phlox divaricata
Hydrophyllum virginicum

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Phacelia dubia
Monarda punctata
Campanula americana
Mertensia virginica
Diervilla diervilla
Campanula americana
Eupatorium sessilifolium
Polymnia canadensis
Chrysogonum virginianum
Helianthus divaricatus
Verbesina alternifolia

The species found throughout the Coastal and Midland Zones which are absent from the Mountain Zone are the following:

Pinus virginiana
Juniperus virginiana
Saururus cernuus
Castanea pumila
Quercus marylandica
Quercus minor
Quercus prinoides
Ulmus americana
Ulmus fulva
Celtis occidentalis
Celtis crassifolia
Asimina triloba
Platanus occidentalis
Euonymus americana
Acer saccharinum
Ceanothus americana
Cornus florida
Diospyros virginiana
Chionanthus virginica
Cunila origanoides
Chrysopsis mariana

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The Coastal Zone.

Among the plants of the Coastal Zone above listed a few are quite common throughout the Zone and leave off abruptly along its inner edge, for example, *Liquidambar styraciflua, Magnolia virginiana, Clethra alnifolia,* and *Quercus digitata.* Other species are less abundant than these but nevertheless occur throughout the Zone and are limited quite as sharply in their distribution by the "Fall-line." The only Coastal Zone plants which occur throughout the Zone are the following:

Woodwardia virginica
Woodwardia areolata
Lycopodium inundatum
Eriocaulon decangulare
Myrica carolinensis
Quercus digitata
*Quercus phellos**
Magnolia virginiana
Itea virginica
Liquidambar styraciflua
Euphorbia ipecacuanhae
Ilex opaca
Ilex glabra
Clethra alnifolia
Leucothoe racemosa
Pieris mariana
Sabbatia dodecandra
*Tecoma radicans**
Viburnum nudum
Lonicera sempervirens
Eupatorium hyssopifolium

Since the entire length of the "Fall-line" in Maryland is but 95 miles, it becomes of interest to inquire into the distribution of the

*Species thus designated occur for 10 to 20 miles above the "Fall-line" along the Potomac River.

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coastal plants of Maryland in the neighboring states, in order to see in how far the same relations of distribution may hold to the north and south. Of the species coextensive with the Coastal Zone all but three are found to the northward only in the Coastal Plain portions of New Jersey and Long Island or in analagous regions in southern New England. The three excepted species are *Woodwardia virginica, Lycopodium inundatum* and *Myrica carolinensis,* which range westward in the northern states as well as southward along the Coastal Plain.*

To the south, the somewhat scant literature as to the occurrence and distribution of plants would indicate that *Clethra alnifolia, Leucothoe racemosa,* and *Ilex glabra* are confined to the Coastal Plain as far as Alabama. A number of others appear to be common in the Coastal Plain and rare in the Piedmont, as *Magnolia virginiana, Itea virginica, Pieris mariana, Viburnum nudum* and *Lonicera sempervirens.* Others range inland above the "Fall-line" in undiminished abundance, as for example *Quercus phellos, Quercus digitata, Ilex opaca* and *Liquidambar styraciflua,* all of which are found throughout the Piedmont of North Carolina (according to Ashe) and throughout Alabama (according to Mohr).

Of those species which are confined to the Coastal Zone in Maryland, but are found only in the southern or southeastern part of it, the majority range to the north of Maryland in the Coastal Plain of New Jersey or to Long Island or even as far north as New England. Following are given the northern limit and the known range in Maryland of these species:

Chamaecyparis thyoides
Northern limit: Massachusetts.
Maryland: Worcester, Wicomico and Dorchester counties.

Sagittaria subulata
Northern limit: New York.
Maryland: Wicomico County.

Erianthus compactus
Northern limit: New Jersey.
Maryland: Worcester, Caroline and Talbot counties.

***Harper, R. M. Coastal Plain Plants in New England. Rhodora, Vol. VII, p. 69; and VIII, p. 27.**

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Uniola laxa
Northern limit: Long Island.
Maryland: Wicomico and Somerset counties.

Cyperus retrofractus
Northern limit: New Jersey.
Maryland: Worcester and Wicomico counties.

Fuirena squarrosa var. *hispida*
Northern limit: New York.
Maryland: Worcester, Wicomico and Charles counties.

Commelina hirtella
Northern limit: New Jersey.
Maryland: Worcester County.

Smilax laurifolia
Northern limit: New Jersey.
Maryland: Worcester, Wicomico and Caroline counties.

Aeschynomene virginica
Northern limit: Pennsylvania.
Maryland: Wicomico and Prince George's counties.

Polygala lutea
Northern limit: Long Island.
Maryland: Worcester, Wicomico, Dorchester, Caroline and Anne Arundel counties.

Ascyrum stans
Northern limit: Long Island.
Maryland: Worcester, Caroline and Talbot counties.

Triadenum petiolatum
Northern limit: New Jersey.
Maryland: Worcester, Somerset, Wicomico and Charles counties.

Ludwigia sphaerocarpa
Northern limit: Massachusetts.
Maryland: Worcester and Talbot counties.

Ludwigia linearis
Northern limit: New York.
Maryland: Worcester County.

Hydrocotyle canbyi
Northern limit: Massachusetts.
Maryland: Worcester County.

Hydrocotyle verticillata
Northern limit: Massachusetts.
Maryland: Worcester and Talbot counties.

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FIG. 1.—VIEW SHOWING STREAM SWAMP ALONG THE LITTLE BLACKWATER RIVER, FOUR MILES SOUTH OF CAMBRIDGE, DORCHESTER COUNTY.

FIG. 2.—VIEW SHOWING FRESH MARSH LYING BEHIND BRACKISH MARSH AND MERGING INTO SANDY LOAM UPLAND FOREST, NEAR GREENBACKVILLE, WORCESTER COUNTY.

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Hydrocotyle ranunculoides
Northern limit: Pennsylvania.
Maryland: Worcester, Caroline, Queen Anne's and Anne Arundel counties.

Polypremum procumbens
Northern limit: New Jersey.
Maryland: Worcester County.

Limnanthemum aquaticum
Northern limit: New Jersey.
Maryland: Wicomico and Dorchester counties.

Asclepias lanceolata
Northern limit: New Jersey.
Maryland: Worcester County.

Koellia aristata
Northern limit: New Jersey.
Maryland: Worcester County.

Gratiola pilosa
Northern limit: New Jersey.
Maryland: Worcester, Dorchester, Caroline and Talbot counties.

Diodia virginiana
Northern limit: New Jersey.
Maryland: Worcester and Charles counties.

Helianthus angustifolius
Northern limit: Long Island.
Maryland: Worcester County.

Senecio tomentosus
Northern limit: New Jersey.
Maryland: Worcester, Wicomico and Caroline counties.

Of those species which are found only in the Coastal Zone in Maryland but are not coextensive with it, a number find their extreme northern limit in the peninsula of Delaware and the Eastern Shore of Maryland, or in the Western Shore District of the Coastal Zone. Following are given the ranges in Maryland of these species:

Taxodium distichum
Maryland: Worcester, Wicomico, Somerset, Calvert and Charles counties.

Sagittaria lancifolia
Maryland: Worcester, Somerset, Caroline and Baltimore counties.

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Panicum digitarioides
Maryland: Wicomico County.

Arundinaria tecta
Maryland: Anne Arundel County.

Cyperus pseudo-vegetus
Maryland: Wicomico, Talbot, St. Mary's and Charles counties.

Kyllinga pumila
Maryland: Charles County.

Scirpus cylindricus
Maryland: Wicomico County.

Rynchospora corniculata
Maryland: Worcester and Charles counties.

Juncus repens
Maryland: Wicomico County.

Myrica cerifera
Maryland: Worcester, Somerset, Wicomico, Dorchester, Caroline and Talbot counties.

Quercus nigra
Maryland: Worcester, Wicomico, Dorchester and Caroline counties.

Cracca spicata
Maryland: Wicomico County.

Rynchosia erecta
Maryland: Worcester, Wicomico and Anne Arundel counties.

Vitis rotundifolia
Maryland: Worcester and Wicomico counties.

Jussaea decurrens
Maryland: Charles County.

Centella asiatica
Maryland: Worcester County.

Symplocos tinctoria
Maryland: Worcester County (fide Rusby).

Vincetoxicum hirsutum
Maryland: Charles County.

Utricularia juncea
Maryland: Worcester County.

Bignonia crucigera
Maryland: Somerset County.

Elephantopus nudatus
Maryland: Worcester County.

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Heterotheca subaxillaris
Maryland: Wicomico County.
Chrysopsis graminifolia
Maryland: Wicomico County.

The southern relationship of the flora of the Coastal Zone is emphasized by the occurrence of members of such families as the Melastomaceae, Bignoniaceae, Loganiaceae, Ebenaceae and Symplocaceae, all of which reach their greatest development in tropical and subtropical regions, as well as by the occurrence of the shrubby Compositae *Iva frutescens* and *Baccharis halimifolia,* the main branches of which are hardy in all but the most severe winters. A number of tropical or subtropical exotics may be grown without winter protection in the Coastal Zone, but are rarely hardy in the Midland. Among these are the Fig (*Ficus carica*), the Mimosaceous tree *Albizzia julibrassin,* the Crêpe-myrtle, (*Lagerstroemia indica*) and the Pomegranate (*Punica granatum*). The predominance of pines, together with the occurrence of several broad-leaved evergreens, marks the relationship with the southern coastal pine belt and with the sub-tropical evergreen broad-leaved forests with which Maryland is in unbroken connection. In March the observer of the vegetation in the Coastal Zone may find leaves on *Magnolia virginiana, Ilex opaca, Ilex glabra, Kalmia latifolia, Kalmia angustifolia, Myrica cerifera, Euonymus americanus* and *Smilax rotundifolia,* as well as on such herbaceous plants as *Chimaphila maculata. Chimaphila umbellata, Mitchella repens, Gaultheria procumbens, Tipularia unifolia* and *Dryopteris achrostichoides.*

The noticeable richness of the Coastal Zone flora in Cyperaceae, Gramineae and Compositae, together with its poverty in rock-plants, vernal herbs and other herbaceous plants of deep forests, leads up to the subject of the habitats which are confined to the Coastal Zone. The marked geologic and topographic features of the Coastal Plain determine the occurrence of plant habitats which are not to be found beyond its borders. Of these it is necessary to mention in some detail a) the Strand, b) the Salt Marshes, c) the Pine Barrens.

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THE STRAND.

The Strand, Beaches and Dunes of the Atlantic Ocean and the lower Chesapeake Bay bear a scanty flora, the members of which are xerophytes but not halophytes, as shown by Kearney* and as confirmed by the occurrence of several of them on the Strand of the Great Lakes.

The plants which are confined to the Strand in Maryland are the following:

Ammophila arenaria
New Brunswick to Virginia; Great Lakes.

Cyperus grayi
Massachusetts to Florida.

Carex silicea
Nova Scotia to Maryland.

Ammodenia peploides
Arctic Regions to Maryland; Europe; Asia.

Cakile edentula
Newfoundland to Florida; Great Lakes; Minnesota; California.

Euphorbia polygonifolia
Rhode Island to Florida; Great Lakes.

Hudsonia tomentosa
New Brunswick to Maryland; Great Lakes; Minnesota; Slave Lake.

Oenothera humifusa
New Jersey to Florida.

THE SALT MARSHES.

The xerophilous plants of the Strand merge, as a class, into the halophytes, and these in turn into the class of fresh marsh plants. The degree of saltness of soil water which halophytic plants are capable of enduring varies from species to species, so that while we find *Salicornia herbacea* and *Spartina stricta* var. *maritima* in pronouncedly salt marshes only, such forms as *Scirpus olneyi, Lythrum alatum* and *Potamogeton crispus* are found only in brackish or even

*Kearney, Thos. H. Are plants of Sea-Beaches and Dunes True Halophytes. *Botanical Gazette*, Vol. XXXVII, 1904, pp. 424-436.

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fresh situations, and *Eryngium virginianum, Ptilimnium capillaceum, Hibiscus mosheutos* and others extend up the tidal streams far beyond the influence of brackish water, yet they are not found, in Maryland, off the larger tidal streams the vegetation of which merges below into purely halophytic marsh. *Solidago sempervirens* is found in all situations from the most saline marshes to those far upstream beyond the influence of brackish water, and as well on the Strand. *Baccharis halimifolia,* which is usually found only along the line separating streams and marshes from the upland, is not infrequent in the Eastern Shore counties growing in pine woods at as much as two to four miles distance from the nearest shore-line, which according to Kearney, is also the case in the Dismal Swamp region.

These statements go to show that the class halophytes is not a strictly coherent one, and that it is difficult to draw a just line between the physiologically true halophytes and a large number of slightly salt-resisting plants which are associated with certain of the halophytes in the brackish and fresh marshes of our tidal rivers. In the following list of the halophytes of the Maryland flora the range of each is given in order to show the wide distribution of the majority of them.

Potamogeton crispus
Massachusetts to Virginia.
Europe.

Potamogeton pectinatus
Cape Breton Island to Florida and Texas.
British Columbia to California.
Europe.

Ruppia maritima
Nova Scotia to Florida and Texas,
Pacific Coast and saline situations in the interior,
South America,
Europe.

Zostera marina
Greenland to Florida.
Pacific Coast,
Europe,
Asia.

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Triglochin striata
Maryland to Florida and Louisiana.
South America.

Spartina polystachya
Maine to Florida.

Spartina stricta var. *maritima*
Maine to Florida and Texas.

Distichlis spicata
Maine to Florida,
Pacific Coast, and saline situations in the interior,

Scirpus nanus
Cape Breton Island to Florida and Texas.
Pacific Coast, and saline situations in the interior,
Europe.

Scirpus olneyi
Rhode Island to Florida and Texas,
Pacific Coast,
Mexico.

Scirpus robustus
Nova Scotia to Texas.

Carex tenera
Maine to Louisiana.

Juncus gerardi
Ontario to Florida.
Great Lakes and Pacific Coast.
Europe.

Polygonum maritimum
Maine to Florida,
Europe.

Atriplex hastata
New Brunswick to South Carolina,
Saline situations in the interior,
Europe.

Salicornia herbacea
Ontario to Georgia, saline situations in the interior, Europe, Asia.

Tissa marina
New Brunswick to Florida, Pacific Coast, Europe, Asia.

Kosteletzkya virginica
New York to Florida and Louisiana.

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Hibiscus moscheutos
Massachusetts to Florida and Louisiana.
Saline situations in the interior.

Eryngium virginianum
New Jersey to Florida and Texas.

Ptilimnium capillaceum
Massachusetts to Florida and Texas.

Limonium carolinianum
Labrador to Florida and Texas.

Sabbatia stellaris
Maine to Florida.

Sabbatia dodecandra
Massachusetts to Florida and Alabama.

Gerardia maritima
Maine to Florida and Louisiana.

Iva frutescens
Massachusetts to Florida and Texas.

Solidago sempervirens
New Brunswick to Florida.
Mexico, Bermuda.

Aster tenuifolius
Massachusetts to Florida.

Aster subulatus
New Hampshire to Florida.

Baccharis halimifolia
Massachusetts to Florida and Texas.

Pluchea foetida
New Jersey to Florida and Texas.
West Indies.

Pluchea camphorata
Massachusetts to Florida and Texas.
Mexico, West Indies.

THE PINE BARRENS.

True Pine Barrens are found only in the Coastal Plain portions of the South Atlantic and Gulf states from Virginia south to Florida and west to Louisiana, being nearly coextensive with the distribution of *Pinus palustris.* Very many plants abundant and characteristic

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in the true Pine Barrens are not found beyond their limits. Pine Barrens occur in the Coastal Plain of New Jersey and Long Island which differ from the true ones in the replacing of *Pinus palustris* by *Pinus rigida,* and of the grassy herbaceous vegetation by shrubs. However, many of the plants characteristic of the true Pine Barrens are found in the Barrens of New Jersey, and there, or in Long Island, find their northern limit.

Neither the true nor the New Jersey type of Pine Barrens is found in Maryland. In the sandy portions of the Western Shore District of the Coastal Zone are areas which resemble the New Jersey Barrens in physiognomy, and in the southern Eastern Shore District are areas which resemble the true Pine Barrens in physiognomy, but nowhere is the characteristic floristic element present. The following are the species which are, in the main, confined to Pine Barren habitats and are found both in the true and the New Jersey Barrens:

Lycopodium alopecuroides
Lycopodium carolinianum
Amphicarpon amphicarpon
Cyperus grayi (also a strand plant)
Dichromena colorata
Rynchospora pallida
Rynchospora torreyana
Carex walteriana
Carex littoralis
Xyris fimbriata
Xyris torta
Eriocaulon compressum
Tofieldia racemosa
Xerophyllum asphodeloides
Helonias bullata
Zygadenus leimanthoides
Aletris aurea
Smilax walteri
Gyrotheca capitata
Lophiola americana
Habenaria integra

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Pogonia divaricata
Arenaria caroliniana
Drosera filiformis
Meibomia stricta
Polygala lutea
Ilex glabra
Hypericum adpressum
Hudsonia ericoides
Rhexia aristosa
Ludwigia hirtella
Dendrium buxifolium
Proserpinaca pectinata
Pyxidanthera barbulata
Sabbatia lanceolata
Gentiana porphyrio
Breweria pickeringii
Trichostema lineare
Koellia aristata
Gerardia linifolia
Sclerolepis uniflora
Eupatorium leucolepis
Chondrophora nudata
Solidago stricta
Solidago fistulosa
Coreopsis rosea

Of this entire list of Pine Barren species the only ones that are known from Maryland are the following:

Cyperus grayi, (Worcester County); *Smilax walteri,* (Anne Arundel County); *Polygala lutea,* (Worcester, Wicomico, Dorchester, Caroline and Anne Arundel counties); *Ilex glabra,* (Worcester, Caroline and Anne Arundel counties), and *Sclerolepis uniflora,* (Wicomico County).

Not only are the species which are rare in the New Jersey Barrens apparently absent from Maryland, but forms very abundant there have not yet been detected in this state, as for example: *Lycopodium*

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alopecuroides, Xyris fimbriata, Xerophyllum asphodeloides, Gyrotheca capitata, Arenaria carolinana, Drosera filiformis, Hudsonia ericoides, Dendrum buxifolium and *Pyxidanthera barbulata.*

The Midland Zone.

The Midland Zone possesses a rich flora, a large part of which ranges, as already stated, from Ontario and New England south to Georgia and Alabama. There are apparently, however, no common plants which are confined to the Midland Zone in Maryland, for those species which do not range south-east into the Coastal Zone do range west into the Mountain Zone, while those not ranging into the Mountain Zone are all found in the Coastal Zone. It is only in the Midland Zone that the limestone plants *Asplenium ruta-muraria* and *Cystopteris bulbifera* and the serpentine plant *Talinum teretifolium* have been found. *Rhus aromatica,* too, has been observed only in the Midland Zone, and appears to be more abundant on limestone.

Under present-day conditions there appears to be a small element of the Midland flora which occurs in the foot hills of Allegany County and in the Blue Ridge and Catoctin Mountains, which is not found in the Lower Midland District. That these species may have occurred in the Lower Midland District when the vegetation of Maryland was in its virgin state appears probable from the rare occurrence there, in favorable habitats, of species which are associated with them in the Upper Midland District. Among these plants are the following: *Pinus pungens, Corylus rostrata, Humulus lupulus, Adlumia fungosa, Spiraea corymbosa, Rubus odoratus, Acer nigrum, Acer spicatum* and *Eupatorium sessilifolium.*

Along the Potomac River, and particularly in the vicinity of the Great Falls, are found a number of species which are known elsewhere only from the Upper Midland District or the Mountain Zone. These are: *Uniola latifolia, Hystrix hystrix, Allium cernuum, Erythronium albidum, Vagnera stellata, Parietaria pennsylvanica. Aconitum uncinatum* (fide Ward), *Trautvetteria carolinensis, Jeffersonia diphylla, Chaerophyllum procumbens, Erigenia bulbosa, Phlox subulata* and *Viburnum pubescens.*

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The occurrence of these species east of the Blue Ridge only along the Potomac may well be accounted for by the transport of seeds by the river.

The Mountain Zone.

An inspection of the ranges outside Maryland of the twenty-nine species already mentioned as confined to the Mountain Zone shows eight of them to be confined to the Alleghany mountains, ranging from New York or Pennsylvania south to North Carolina or Georgia. These are: *Clintonia umbellulata, Cimicifuga americana, Anemone trifolia, Bicuculla eximia, Saxifraga micranthidifolia, Azalea lutea, Menziesia pilosa* and *Solidago monticola.*

The remaining number of Mountain Zone species range in the North from Newfoundland, Nova Scotia or Ontario west to Michigan, Minnesota or Manitoba, or indeed as far as Alaska in the case of *Streptopus roseus* and *Cornus canadensis.* Of the total number of Mountain Zone species the southern limit of range in the Alleghanies is as follows: 14 south to Georgia, 7 to North Carolina, 1 to Virginia, 7 to Maryland. The species finding their southern limit in Maryland are the following: *Larix laricina, Alnus incana, Coptis trifolia, Dalibarda repens, Cornus canadensis, Gentiana linearis* and *Lonicera ciliata.*

The most conspicuous habitat confined to the Mountain Zone is the swamp forest, which finds its typical development in the narrow mountain valleys with insufficient longitudinal slope to effect ready drainage. In and about these swamps are found a number of the typically northern forms, for example *Picea mariana, Larix laricina, Cornus canadensis, Dalibarda repens, Gentiana linearis,* and *Coptis trifolia.* The predominance of *Picea mariana* and *Pinus strobus* along streams, in swamps and on the rich soil of flood plains and glades is of considerable interest in connection with the absence from the Mountain Zone of such common species characteristic of similar habitats in the Midland and Coastal Zones as *Ulmus americana, Ulmus fulva, Platanus occidentalis* and *Acer saccharinum.*

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General Considerations.

The floristic distinctness of the three Zones of Maryland rests on the fact that their boundaries are the collective limits of geographical distribution of considerable numbers of species. Not only are certain species limited absolutely in their range by the "Fall-line" or by the contour of 1500 feet elevation, which are the natural lines bounding the Zones, but others are abundant on one side of these bounds and rare on the other; in other words some plants terminate abruptly in their range, while others merge from abundance through infrequency to rarity, and at length disappear. *Liquidambar styraciflua, Clethra alnifolia* and the other plants listed on page 76 are examples of such as terminate abruptly in range, while *Tsuga canadensis* merges from abundance in the Mountain Zone and the Upper Midland District through scarcity in the Lower Midland District to rarity in the Coastal Zone.

The importance of temperature in determining the bounds of plant distribution has long been recognized and is still being overemphasized by certain writers. The importance of conditions directly or indirectly determined by the character of the soil in controlling the local distribution and occurrence of plants has also been appreciated since the writing by DeCandolle of his "Essai Élémentaire de Géographie Botanique" in 1820. While the immediate influence of climatic factors, particularly temperature, in determining the geographical distribution of plants is by no means to be underestimated, it needs, nevertheless, to be borne in mind that local soil conditions not only determine the occurrence of plant species within their area of distribution, but in many cases play a part also in determining the exact position of their limit of geographical distribution. An inquiry into the nature of the habitat of several species which have the same geographical range will again and again show the habitat of these species to be the same, as is true of the pine barren plants of the southeastern states and the bog plants of the northern states, the geographical distribution of these species being largely dependent on the distribution of the particular physical conditions which are favorable to their development.

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Those particular constellations of physical conditions which we are accustomed to designate by the loose term "habitats" are different from each other chiefly by reason of differences in soil conditions, operating directly or indirectly. The fundamental determination of the soil characteristics of habitats by geology and topography and by physiographic changes, gives to the most marked habitats a definite geographical range. The three classes of plants of the Coastal Zone of Maryland which have already been listed, those of the Strand, of Salt Marshes and Pine Barrens are examples of plants which are limited to the Coastal Zone in their distribution by reason of the limitation of their habitats through geologic and physiographic causes. Each of the Floristic Zones possess habitats almost as strongly marked in their physical conditions and their vegetation as are the Salt Marshes and the Strand, as for example the Serpentine Barrens of the Lower Midland District and the Swamps of the Mountain Zone. In addition to these each Zone possesses many less sharply marked habitats in which the physical conditions are not so extreme and the vegetation not so distinctive. The Sandy Loam Upland Swamps and the Sandy Stream Swamps of the Coastal Zone are characterized by the abundance of several species which are infrequent in the Midland and Mountain Zones, as well as by purely Coastal species. In a sandy swamp two miles southeast of Towson, Baltimore County, and therefore about seven miles from the "Fall-Line" are to be found *Liquidambar styraciflua, Ilex opaca, Magnolia virginiana, Clethra alnifolia* and *Viburnum nudum,* all of which, excepting *Ilex opaca,* are unknown from any other stations off the Coastal Plain. On the southern slope of Sugar Loaf Mountain, in Frederick County, 32 miles from the "Fall-line," the soil is a coarse sand derived from disintegration of the underlying sandstone. In certain places where the topographic conditions render this soil constantly wet or even saturated, may be found *Chionanthus virginica, Ilex verticillata, Eupatorium verbenaefolium, Eupatorium rotundifolium, Rynchospora glomerata, Xyris caroliniana, Triadenum virginicum* and *Juncus dichotomus,* all of which are common in the wet sandy habitats of the Coastal Zone, but are rare in the Midland Zone, being found only in such habitats as that just described. In like manner the species common in the Midland Zone may be found infre-

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quently in favorable habitats in the Coastal Zone. In Charles and St. Mary's counties, about the head of the Wicomico River, are narrow ravines in which Susquehanna gravel is underlaid by an extremely compact and impermeable gray clay of Miocene age, analagous to underlying rock in its relation to soil water movement. This causes the soil conditions to resemble closely those of ravines in the Midland Zone, and here may be found such species as *Cercis canadensis, Hamamelis virginiana, Hydrangea arborescens, Cimicifuga racemosa, Heuchera americana* and *Carex platyphylla,* all of which are rare in the Coastal Zone. These facts indicate that the texture of the soil and its topographic position largely determine the occurrence of species which, were it not for the existence of these favoring habitats of restricted area, might be presumed to be absent from extended districts.

Any study of the bounds of species must keep in view the three sets of factors which are operative in determining the general area of distribution of plants—namely the historical, climatic and edaphic, the last comprising all the factors immediately determined by the physical and chemical characteristics of the soil. The historical considerations which have to do with the range of a species relate to its phylogenetic origin, its migration and its distribution at successive geological periods. The nature of the area of distribution of a number of the Coastal species of Maryland at the present day is such as to indicate that they have migrated northward in the Coastal Plain from the South Atlantic states since the most recent elevations of the Coastal Plain. These are species which had their origin in the South Atlantic states or had been driven thither during the Glacial Epoch. The genus *Liquidambar* was represented during pre-glacial time by several species of wide distribution through the northern hemisphere, yet *Liquidambar styraciflua* is at present confined to the Coastal Plain, at least east of the Alleghany Mountains. *Clethra alnifolia* is known from the Interglacial beds of the Don River Valley, Canada, which points to the more extensive distribution of this species during the era of mild climate between the two periods of maximum glaciation, than at present. *Liquidambar* and *Clethra* are examples of species which sought a retreat in the southeastern states during Glacial time and have since migrated north-

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ward along the newly emerged Coastal Plain. Among the numerous species endemic to the pine barrens of the southern Coastal Plain are doubtless many which have originated since the Glacial Epoch.*

The present limit of distribution of species coextensive with the Coastal Plain is determined by their manner and rate of migration quite as much as by any existing external factors. The sharpness with which these species are limited by the "Fall-Line" points to their northward migration since Glacial time. The limitation of species by climatic factors is largely, though not solely, a matter of temperature. The gradually decreasing temperature of the growing season encountered in passing northward in the Coastal Plain is paralleled by the gradual disappearance of species.† In spite of the importance of the temperature element of the climate in relation to the general area of distribution of plants, it is not possible to ascribe the limiting of the Coastal Zone species to this or to any combination of climatic factors. The edaphic conditions in the Coastal Zone and the Midland Zone are in sharp contrast owing to the presence of underlying rock in the former, the greater predominance of sands and sandy loams in the former and of loams and clays in the latter, and the totally different topography in the two.

The facts already related as to the importance of edaphic factors in conditioning the occurrence of Coastal species in the Midland Zone and *vice versa,* are not without bearing on the case of the species entirely restricted to the Midland and Coastal Zones. The complete limitation of species to the Coastal Zone is but a step further in the operation of the same laws that limit the Coastal species to restricted habitats when they occur in the Midland. The broader lines of distribution are drawn by historical and climatic factors, the minor details of the limitation of distribution, as well as of local occurrence, are due to edaphic conditions. Where a sharp line of demarcation occurs between regions of different edaphic character, as the "Fall-

*The criteria which serve to indicate the place of origin and paths of migration of species have been well summed up by Adams, C. C., The Southeastern United States as a centre of Geographical Distribution of Flora and Fauna, Biological Bulletin, Vol. III., No. 3, 1902, pp. 115-134.

†For exact data as to the northern limit of distribution of southern Coastal Plain species see: Kearney, Thomas H., Report on a Botanical Survey of the Dismal Swamp Region. 1901, pp. 451-457.

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line," the bounds of species which history and climate brings near the line, will there coincide with it, while in other parts of the range of the plant, where its history has been different or the climate now differs, it may be able to override quite as distinct a line of edaphic demarcation.

Several of the species confined to the Coastal Zone may be found in cultivation in the Midland Zone. The writer has noticed *Magnolia virginiana* and *Tecoma radicans* at Cumberland, and *Lonicera sempervirens* near Midlothian, Allegany County. *Ilex opaca,* too, while never found as a tree in the Midland Zone, occurs as a rare shrub. These facts indicate that there is nothing in the slightly more rigorous climatic conditions of the Midland Zone to exclude the species named, and point to the cause of the limitation of their present migration as being uncongenial soil conditions or the competition of plants more accurately adjusted to these soil conditions.

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PART III

THE ECOLOGICAL PLANT GEOGRAPHY OF MARYLAND

BY

FORREST SHREVE, M. A. CHRYSLER AND
FREDERICK H. BLODGETT

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THE ECOLOGICAL PLANT GEOGRAPHY OF MARYLAND; COASTAL ZONE; EASTERN SHORE DISTRICT

BY

FORREST SHREVE

Introductory.

The vegetation of the Eastern Shore District of the Coastal Zone is more highly diversified than that of any of the other ecological districts of Maryland. This is due in part to the variety of soils, in part to the extent and diversity of the swamps and marshes, and in no small share to the fact that the most common and characteristic forest tree of the southernmost counties, the Loblolly Pine (*Pinus taeda*), finds the northern limit of its range for Maryland in Kent and Queen Anne's counties, while several of the tree species common in the latter countries, as well as in the Midland Zone, are rare or absent on the southern Eastern Shore. The most conspicuous difference between the upland forests of the upper and lower counties of the Eastern Shore is that the former are deciduous, with oak, chestnut and hickory predominating, while the latter are evergreen with the Loblolly Pine predominating, or the Loblolly together with the Scrub Pine (*Pinus virginiana*).* The visitor to the shores of the Anemessex River, in Somerset County, will find a forest composed almost solely of Loblolly Pine, in which the Chestnut and the Chestnut Oak are absent; while on the hills of Elk Neck, in Cecil County, he will find that the last-named trees form almost the entire forest stand and that the Loblolly is absent, not ranging so far north.

While the limits of the ranges of trees are important in bringing about a diversity of forest composition in different sections of the

*The Loblolly is locally known on the Eastern Shore as the "Bull Pine" and the Scrub Pine as the "Spruce Pine."

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Eastern Shore, yet the character of the soils is of very great importance in this respect. In Kent County near the limit of the Loblolly Pine it occurs only on Elkton Clay and Meadow,* while in Worcester and Wicomico counties it occurs on soils of every texture from clay to sand. In the northern part of Wicomico County and the southern part of Talbot County occur loams which support a forest largely made up of deciduous species, and on similar soils in northern Queen Anne's and in Kent counties is a similar forest made up exclusively of deciduous species. While the general distribution of the Loblolly Pine is determined by historical and climatic factors, yet its relative abundance at different localities within its area is determined by the character of the soil. While it grows on a diversity of soils 100 miles south of its limit, yet it extends to its limit chiefly on the soils which are everywhere most favorable to its dominance. The occurrence of deciduous forests on loam at points 50 miles south of pure stands of Loblolly Pine on Elkton Clay shows the great importance of soils in sorting and rendering locally dominant or rare the various species of the arborescent flora.

As already pointed out in the introduction, the soils of the Eastern Shore fall into two classes of very distinct texture a) the heavy Elkton Clay, Meadow and related soils (locally known as "white oak soil") and b) the various types of sand and sandy loam. While the distinctness of the physical texture of these two classes of soils is the primary factor in determining the character and distribution of vegetation in the upland, nevertheless the topography plays a secondary role in determining the average moisture content of both the heavy and the light classes of soils. In the River Swamps and Marshes the topographic position, conditioning as it does a saturation of the soil, reduces the importance of its physical texture to a negligible minimum. Yet in the Upland Swamps the character of the soil does cause differences of vegetation in spite of its high moisture content, because of the more favorable conditions for the movement and aeration of the soil water in the Sandy Loam Upland Swamps as contrasted with the Clay Upland Swamps. Indeed the differences in the vegetation of the heavy and light soils here should not be

*The term "Meadow" is here employed in the technical sense in which it is used by the United States Soil Bureau.

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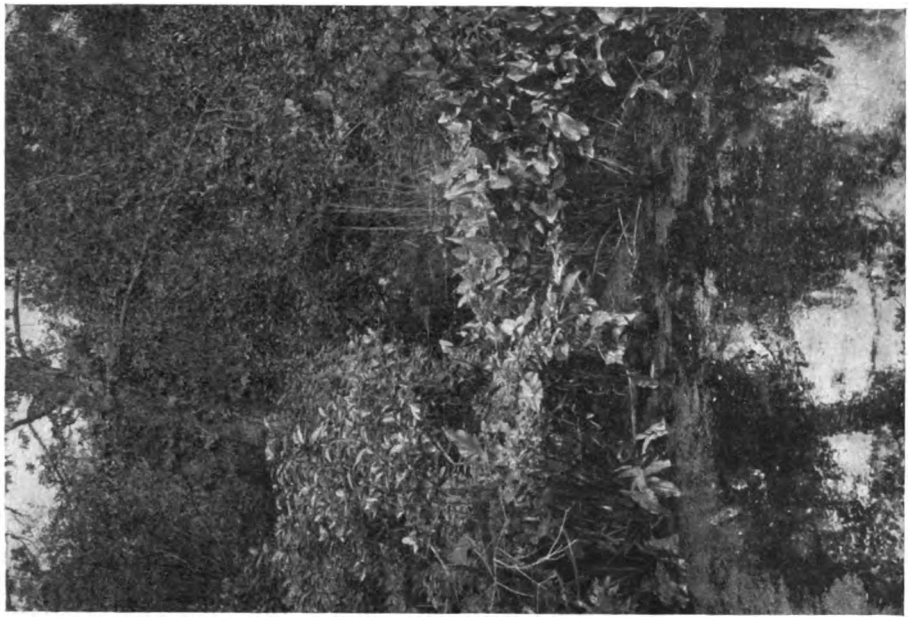

FIG. 2.—VIEW SHOWING STREAM SWAMP WITH RED MAPLE, SWEET GUM, VIBURNUM, PELTANDRA AND RICCIA, LITTLE BLACKWATER RIVER, DORCHESTER COUNTY.

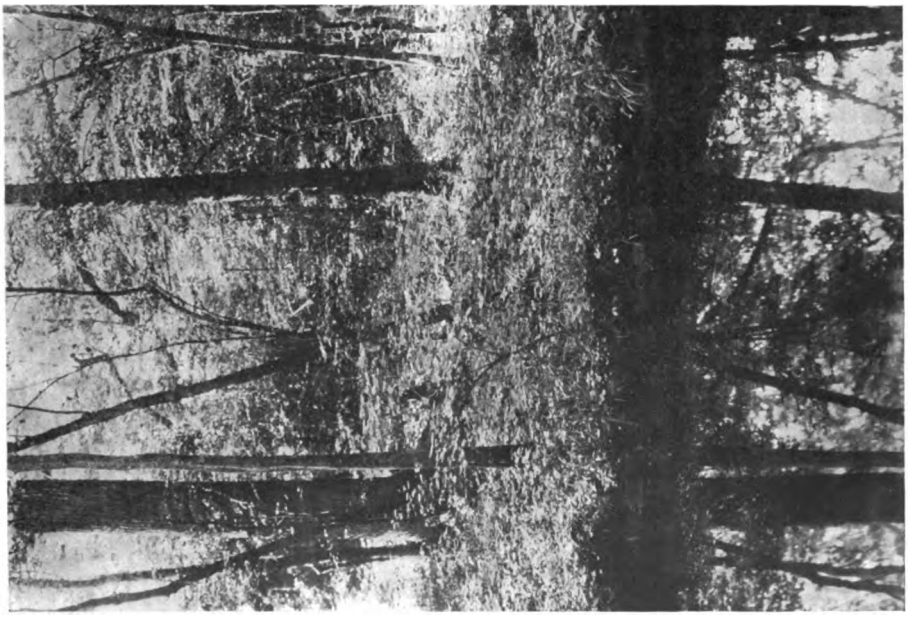

FIG. 1.—VIEW SHOWING FLOOD-PLAIN FOREST ON THE WICOMICO FORMATION, HERRING RUN, CAROLINE COUNTY.

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attributed entirely to their physical texture in view of the almost universal acidity of the Elkton Clay and Meadow.

A matter of considerable importance in relation to the distribution of vegetation on the Eastern Shore is the position and character of the Talbot and Wicomico formations, the most recent deposits of Pleistocene age. These formations exist as nearly level terraces, the former and older of which lies almost entirely inland and is in an early sequential stage of erosion, while the latter borders the Chesapeake Bay as a low terrace of varying width. The features of the

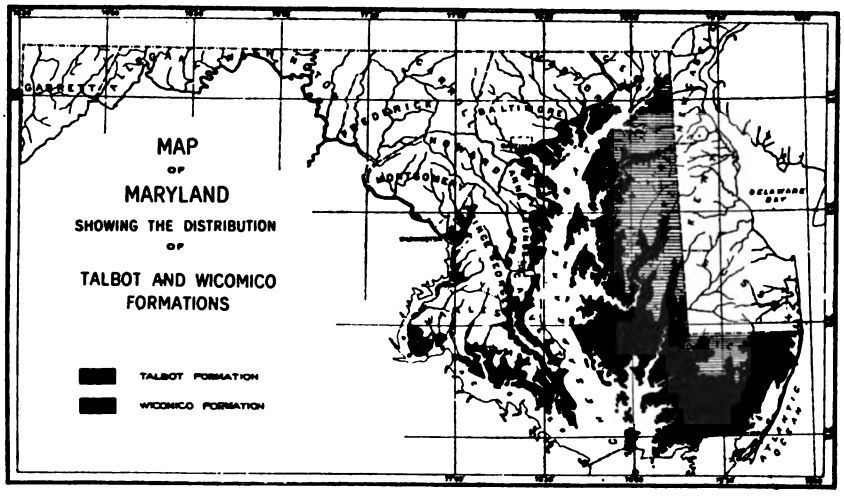

FIG. 4.—Map of Maryland showing the distribution of the Talbot and Wicomico formations.

topography and soils of these formations have been described in the introduction and their area is shown on the accompanying map.

In the Talbot Formation there is no relation between the topography and the distribution of the soils, so that there occur areas of well-drained Elkton clay or Meadow and well-drained sandy loams and sands, as well as areas of these same soils which lie so as to be almost constantly saturated. Distinctions are observable between the vegetation of the well drained clay and the well drained light soils. and also between the poorly drained areas on the two classes of soils. The well drained soils will be here designated as "Upland" and the poorly drained ones as "Upland Swamps," in distinction to the

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swamps which border streams. Upland Swamps commonly occupy the ill-defined divides between streams, yet altogether identical swamps occur back of broad areas of marsh. Many considerations make it more natural to treat the Upland Swamps in connection with the Upland rather than with the River Swamps and the Stream Swamps, one of the most important of these being the easy transition which often exists between the Upland and the Upland Swamps. The poor drainage of the Talbot terrace causes considerable fluctuations in the soil moisture conditions of Upland Swamps according to rainfall. Inundation is common on the clay in the early summer; on the lighter soils the fluctuations of moisture content with rainfall are more rapid, and the Upland Swamps on these soils are more sharply limited as well as more distinct from the Upland in their vegetation than is the case on the clay.

As pointed out in the introduction, the sandy loams and sands predominate in the Talbot terrace south of the Nanticoke River, with small areas of Elkton clay lying inland. On the Bay side of Somerset County and north of the Nanticoke River the Elkton clay and Meadow predominate in the Talbot terrace. Throughout Somerset, Dorchester, Talbot and Queen Anne's counties the Upland Clay Forest is a pure stand of the Loblolly Pine or a mixed stand in which that tree is dominant. The existence of the pure stands is to be accounted for in part by the possible influence of the immediate proximity of tide-water in excluding other species, and in part by the fact that in this area and upon this soil the Loblolly Pine is the tree which most readily reseeds abandoned fields and some cut-over areas. In Worcester and Wicomico counties, where the areas of Elkton Clay lie remote from the tide-water, the forest exhibits a predominant proportion of the same deciduous species which in less percentages are characteristic of the soil nearer to tide water. In Kent County the Loblolly Pine reaches its northernmost range and pure stands of it have not been seen north of Cliffs Landing, on Chester River, nor isolated trees north of Fairlee. The Elkton clay of Kent County, however, and the almost identical Meadow as well, bear a forest made up of just those species which are associated with the Loblolly Pine to the Southward. These are such trees as are

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found on other soils chiefly in swamps or low ground, and the fact is even more notably applicable to the shrubs.

The Clay Upland Swamps occur extensively in Dorchester County and are characterized by a close similarity to the ordinary Clay Upland forest, but have a greater proportion of deciduous trees, a richer and constant stand of shrubs and almost complete absence of herbaceous vegetation. Here prevail conditions extremely hostile to soil aeration, and the plant covering is more notable for the species which are absent from it than for those that are present.

Under Sandy Loam Upland Forests and Sandy Loam Upland Swamps will be comprised the description of all vegetation on the Sassafras and Portsmouth sandy loams as well as on the Norfolk and Portsmouth sands, for there are no marked and constant characteristics distinguishing the plant-covering of these several soils. On the Sandy Loam Uplands there may occur pure or nearly pure stands of the Loblolly Pine, but these are beyond doubt due to artificial conditions. There is no doubt but that the virgin forests of the lighter soils of the Talbot formation formed a mixed stand of pine and deciduous species. The Scrub Pine is a frequent associate of the Loblolly in the Sandy Loam Uplands, and at many localities 50 per cent. of the forest is made up of the Scrub Pine, the White Oak, other oaks and the Sweet Gum.

The Sandy Loam Upland Swamps occur chiefly south of the Nanticoke River, and may occupy untapped divides or may lie back of marshes. The predominant tree is the Loblolly Pine, while the admixture of 10 to 40 per cent. of deciduous species is made up of the Willow Oak, Water Oak, Cow Oak, Holly, Magnolia and White Oak. Where the deciduous species are more abundant the undergrowth is dense; where the Loblolly is dominant the undergrowth is sparser.

The Upland forests of the Wicomico terrace exhibit a marked difference in their composition as one travels northward from Salisbury through the portions of Wicomico, Caroline, Queen Anne's and Kent counties which lie near the Delaware line. The difference is chiefly due to the gradual disappearance of the Loblolly Pine and the coming in of hickories, the Chestnut and the Chestnut Oak, resulting in a transition from forests which are chiefly coniferous in

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Wicomico County to those that are entirely deciduous in Kent. Pure stands of the Loblolly Pine are not wanting on the Wicomico terrace in Wicomico County, and the Scrub Pine is far more abundant than on the Talbot terrace. The two pines occur together, sometimes forming purely coniferous forest or in other localities farther north exhibiting an increasing percentage of deciduous trees. The Scrub Pine is found in pure stands at many places in Caroline County, due again to unusual conditions. It is only to the north of Denton, Hillsborough and Queenstown that the deciduous element is dominant.

The Ravine Slopes of the Wicomico terrace are distinguished in their vegetation by relationship with the Midland Zone forests. These slopes are either old beaches of the Talbot sea, in which case they may lead down to flood plains with meandering streams or to estuaries, or they may lie at a greater elevation and be due to the erosion of the Wicomico terrace. The soil is often gravel* forming a congenial habitat for the Chestnut and Chestnut Oak, the former of which reaches its southern limit for the Eastern Shore near Agner, Caroline County, and the latter at Watts Creek, Caroline County, both stations being on Ravine Slopes.

The narrow Flood Plains along the streams of the Wicomico terrace, which have been deposited since the initial stages of the erosion of the terrace, possess deep rich soils the water content of which is constantly higher than that of the Upland, but varies with the degree to which the Flood Plain has been built up. The arborescent flora of this habitat is related to that of similar habitats in the Midland Zone rather than to any of the types of Swamp on the Eastern Shore.

The Upland Swamps of the Wicomico terrace are most abundant in the northeastern part of Queen Anne's County, where they occupy the uneroded surface of the terrace at elevations of 60 to 70 feet, at not more than five to eight miles from tide water. With the exception of the absence of pine these Swamps bear a close resemblance to the Clay Upland Swamps of Dorchester County, both in their tree species and in the luxuriance of the undergrowth. Among the commonest trees are Black Gum, Swamp Oak, Red Maple and Sweet Gum.

*See the Soil map of Kent County; Division of Soils, Field Operations, 1900.

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Along the Pocomoke River and its tributaries, Dividing and Nassawango creeks, is found a type of swamp, which will here be designated as "River Swamp," in which the Bald Cypress is the characteristic tree. These Swamps extend from just above Rehoboth to the Delaware line, occupying a zone on each side of the river not exceeding half a mile in width. The soil of the River Swamps is saturated or at times inundated, the level of the river varying with both tide and rainfall. The White Cedar is a rare associate of the Bald Cypress, the other species being deciduous, as Red Maple, Black Gum, Sweet Gum and Green Ash. There is a scattering growth of shrubs but the herbaceous vegetation is very poor.

Considerable difference is observable between the River Swamps of the Pocomoke and the type of Swamp which borders the upper waters of the Nanticoke and Choptank and all the smaller streams of the Talbot formation, which will be designated "Stream Swamps."* The most striking characteristic of the Stream Swamps is the low stature of the trees and the irregular sky-line which they present. While the River Swamps begin on the Pocomoke just above the highest point of saline influence, the Stream Swamps do not appear in ascending the Choptank until 20 miles of brackish and fresh marsh have been passed. There is no obvious difference in the physical conditions on the two rivers to account for the difference between the occurrence of swamp on the one and marshes on the other. It is true that the Bald Cypress does not occur on the Choptank River (and apparently not on the Nanticoke, while it is rare on the Wicomico), and leaving out the Cypress from the River Swamps would make them not very different in composition from the Stream Swamps, although they would still be very different in the higher and regular stature of the trees, and in the accompanying herbaceous vegetation. If the difference were merely a matter of the range of the Cypress we would expect to find Stream Swamps on the Choptank where we find marshes.

The Marshes of the Eastern Shore fall into two classes, salt and fresh, which grade into each other along the larger streams. The

*The Stream Swamps are locally known as "cripple," a word which is said to be a contraction of the Dutch *kreupelbosch*, meaning underwood, a word borrowed by the early settlers of New Jersey from their New York neighbors.

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Salt Marshes are characterized by a simplicity of flora and by a uniform physiognomy of the vegetation, while the Fresh Marshes are usually extremely rich in species, and vary greatly in aspect and flora in places only a few rods apart. In the broad marsh lands of Dorchester County the fresh portions of the marsh next the Upland resemble the Salt Marshes in their uniformity of physiognomy and to some extent in their simplicity of flora. Along the upper waters of the larger rivers the Marshes give place to Stream Swamps with an outer zone of emersed aquatic plants. The Salt Marshes have their greatest extent through Somerset, Dorchester and Talbot counties, along the Chesapeake Bay and its larger estuaries. In the estuaries which end bluntly, as the Anemessex in Somerset County and the Little Choptank in Dorchester County, the Salt Marsh is found to their heads, while in those that are fed by fresh rivers, as the Nanticoke and Choptank, the Salt Marsh merges into Fresh Marsh at about the point where the estuary ceases and the stream may be said to begin. Along the landward side of Sinepuxent Bay and Chincoteague Bay (Assateague Sound) there is considerable marsh land, which is mostly Fresh Marsh, merging back into Sandy-loam Upland Swamps.

The fresh water aquatic vegetation of the Eastern Shore is best developed in the artificial mill-ponds, where species are found in abundance which must have been much less common under virgin conditions, when their occurrence was limited to the streams. The difference in the floras of quiet and running waters are slight. There are but few stagnant ponds and no peat bogs in the Eastern Shore. The aquatic flora of brackish waters is poorer than that of the fresh, and that of salt water poorer still. The map (Plate V.) drawn to show the distribution of terrestrial halophytic plants will serve equally well to show the lower limits of the brackish water aquatics in the rivers and at the head of the Chesapeake.

The vegetation of the Dunes and Strand along the ocean front is characteristically devoid of trees and made up of a limited number of species of grasses and other herbaceous plants of xerophilous character. At several places in Chesapeake Bay there are recently formed hooks and spits in which the soil is a coarse sand and the vegetation similar to that of the Ocean Dunes.

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Permitting the above brief sketch of the character and location of the plant habitats, or habitat-groups, of the Eastern Shore to serve to orient the reader, each of these will now be treated in detail in the order mentioned.

Upland Vegetation.

THE TALBOT TERRACE.

Clay Upland.—No one who has traveled the waters of the Chesapeake Bay can have failed to notice the pure stands of Loblolly Pine which occupy islands and narrow necks of land adjacent to tide water, as at Poplar Island in Talbot County, and near Marion in Somerset County. In the interior such pure stands are not absent, but far less frequent than are mixed stands in which the Loblolly predominates. In what manner and to what extent the proximity of salt water may be responsible for the purity of these stands is not apparent upon observation, but their almost universal occurrence in such situations makes it at least probable that there may be some such influence operating to eliminate other tree species, and that the pure stands are not due, in all cases at least, to artificial reforestation. Away from the immediate proximity of the shore the typical forest of the Clay Upland has the Loblolly Pine as its predominant tree with from 15% to 50% of the Scrub Pine or deciduous species. In the Elkton Clay of central Worcester County, however, the Loblolly gives way to a larger percentage of the accompanying trees, while in Kent County and the small areas of Elkton Clay in Cecil County the deciduous species alone make up the forest stand.

The Scrub Pine is never so abundant as the Loblolly Pine in the typical areas, although it is more so at some localities in central Worcester County, as near Wesley. In Talbot County the Scrub Pine is rare in the lower part of Bay Hundred District, Broad Creek Neck and Deep Neck; in the upper part of Broad Creek Neck and near Claiborne there are some stands in which it forms 15%, while near Royal Oak it increases to 30% of the stand. The increase in the proportion of the Scrub Pine on passing inland is characteristic of all parts of the Elkton Clay, and its absence

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from the Clay Upland Swamps, together with its abundance on the lighter soils of the Wicomico formation points to the better drainage and aeration of the clay as being more favorable to its occurrence. The deciduous species which are the most frequent and abundant associates of the Loblolly on the Elkton Clay are the Sweet Gum and the White Oak. Near the shores the Sweet Gum often occurs in small percentages as the only deciduous tree, as at many places in Bay Hundred District in Talbot County. Other common associates are the Willow Oak, the Spanish Oak and the Sour Gum.*

In the extensive clay areas of Dorchester County the Loblolly is dominant; its most characteristic associates are the White Oak, the Spanish Oak, the Sweet Gum, the Swamp Oak, the Willow Oak and the Sour Gum; with 10% to 15% of the forest made up of Scrub Pine, Black Oak, Persimmon, Dogwood, Holly, Pig-nut Hickory, Sassafras, Red Maple and Beech. In central Worcester County the dominance of the Loblolly yields to a grouping of Loblolly, Scrub Pine, Willow Oak, White Oak and Swamp Oak, with the deciduous species often predominating. On the Meadow soil of Kent County, near Tolchester, there is a purely deciduous stand of Willow Oak, White Oak, Sweet Gum, Red Maple, Spanish Oak, Sweet Gum and Black Haw, the same species that are the associates of the Loblolly in Talbot and Dorchester counties. On one of the northernmost areas of Elkton Clay, a ravine bottom near Elkton, Cecil County, is a stand of Willow Oak, White Oak, Black Oak, Chestnut, Beech, Red Maple, Pig-nut Hickory and Holly, which agrees in make-up with the deciduous element of the typical areas, with the addition of the Chestnut, which is extremely abundant on neighboring soils in Cecil County. The Elkton Clay Upland and the Elkton Clay Swamps are notable throughout for the absence of Scrub Pine, Black Jack Oak, Tulip tree and the Elm, all of which are abundant on other soils of the Talbot formation or on the Wicomico terrace.

In June 1904 a grove of Loblolly Pine near Claiborne, Talbot County was visited, which has since been cut. The pines were

*In all enumerations of species they are named in the order of their abundance.

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FIG. 1.—VIEW SHOWING SAND SPIT WITH DUNE AND STRAND VEGETATION, MOUTH OF FAIRLEE CREEK, KENT COUNTY.

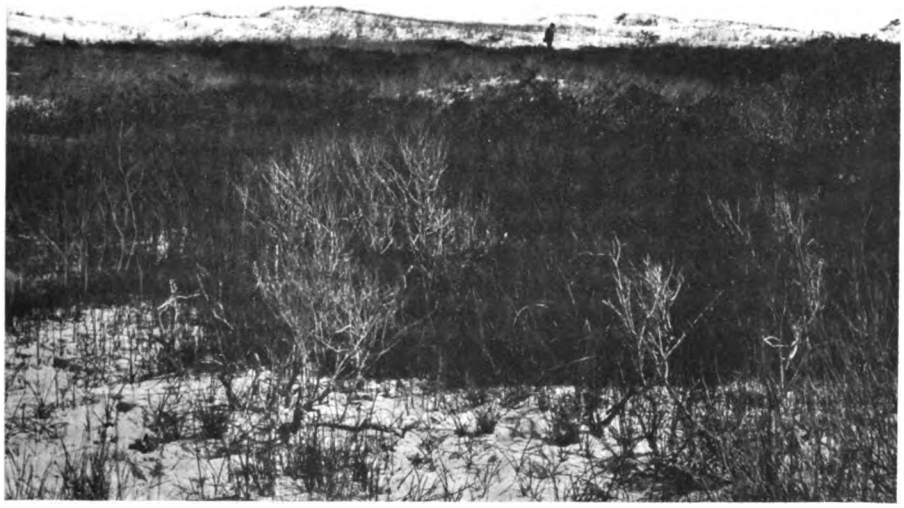

FIG. 2.—VIEW SHOWING THE SAND DUNES ALONG THE ATLANTIC, NEAR OCEAN CITY, WORCESTER COUNTY.

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about seventy-five years old and 80 feet high, the grove displaying a physiognomy which was undoubtedly much nearer that of the virgin forests of the Clay Upland than any other stand seen. There were no deciduous trees of the same height as the pines, but there were enough from 40 to 60 feet high to form a nearly continuous canopy of deciduous foliage beneath that of the pines. The Spanish, White and Black Oaks made up about 70% of the deciduous trees, Sweet Gum, Holly and the Willow Oak forming the remainder. Among the saplings 6 to 10 feet in height were a number of Chestnut and a few of the Chestnut Oak, neither of which trees has been seen elsewhere in more than four localities off the gravel beach of the Talbot sea south of Denton and Queenstown. With them were Dogwood, Bayberry and the Blue berry and young trees of the Holly. The herbaceous vegetation was very poor and the seedling trees were exclusivly those of the predominant oaks.

The shrubby vegetation of the Clay Upland Forests varies in its density in accordance with the dominance of the coniferous or the deciduous trees. In pure or nearly pure growths of the Loblolly or the Loblolly and Scrub Pines the shrubs are few and scattered, the floor of the forest often being almost bare of any vegetation and smoothly carpeted with pine needles. Where the deciduous trees are more abundant the shrubs are more numerous. In the pure stands of Loblolly near tide-water *Myrica carolinensis, Myrica cerifera* and *Baccharis halimifolia* are the commonest shrubs. Elsewhere additional common species are:

Vaccinium stamineum
Vaccinium corymbosum
Gaylussacia resinosa
Viburnum dentatum
Azalea nudiflora
Xolisma ligustrina
Viburnum prunifolium
Aralia spinosa
Aronia arbutifolia.

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The herbaceous vegetation of these forests is poor both in species and individuals. The Grasses and Sedges are abundantly represented, while even the best drained areas are poor or wanting in a number of forms characteristic of the Sandy Loam forests, as for example the species of *Meibomia* and *Lespedeza, Baptisia tinctoria, Stylosanthes biflora, Cassia nictitans, Euphorbia ipecacuanhae, Adopogon carolinianum, Specularia perfoliata* and *Ceanothus americanus.* In the pure or nearly pure coniferous stands the following are the commonest species:

Melampyrum lineare
Panicum capillare
Panicum barbulatum
Solidago bicolor
Danthonia spicata
Chimaphila maculata
Panicum microcarpon
Eatonia nitida
Oxalis stricta
Aster undulatus
Chimaphila umbellata
Eatonia pennsylvanica
Carex caroliniana
Anthoxanthum odoratum
Solidago odora
Cassia chamaecrista
Lespedeza procumbens
Carex vestita.

Clay Upland Swamps.—Clay Upland Swamps are not sharply delimited from the Clay Upland, as before stated. They are to be found in their most pronounced character and greatest extent in Dorchester County in Drawbridge, Bucktown, Church Creek, Lakes and Parsons Creek Districts—the region in which there is the largest area of Elkton Clay or related soils undissected by estuaries.

The Upland Swamps never bear pure stands of Loblolly Pine, and Scrub Pine is altogether absent, while the same deciduous

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species that are subordinate in the Upland are here more abundant. Among these Sweet Gum, White Oak, Sour Gum, Willow Oak, Red Maple and Swamp Oak are the most frequent, while Holly and Cow Oak are occasional. In many localities the Loblolly Pine forms as little as 10% or 15% of the stand.

The shrubs are richer in the number of individuals than in any other forests of the Eastern Shore District, comprising:

Clethra alnifolia
Xolisma ligustrina
Vaccinium corymbosum
Azalea viscosa
Leucothoe racemosa
Viburnum dentatum
Itea virginica
Viburnum prunifolium
Magnolia virginiana
Ilex verticillata
Cornus florida
Alnus rugosa.

The dense shade of the trees and shrubs makes the floor of the Clay Upland Swamps very poor in herbaceous vegetation. The only common species are: *Carex caroliniana, Carex comosa, Panicularia pallida, Carex lupulina, Carex hirta.*

Thin and scattered beds of peat moss (*Sphagnum*) are extremely abundant in the swamps, although unaccompanied by any characteristic bog plants. In depressions in the forest where there is standing water throughout at least the early summer may be found a richer representation of palustrine plants.

Myriophyllum verticillatum
Polygonum hydropiper
Isnardia palustris
Proserpinaca palustris
Lycopus rubellus
Triadenum virginicum
Gratiola sphaerocarpa

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Callitriche heterophylla
Rhexia mariana
Juncus effusus
Eleocharis tenuis
Eleocharis engelmanni.

Sandy Loam Upland Forests.—In the Sandy Loam Upland Forests on the Talbot terrace the coniferous trees frequently form pure stands, and in the mixed stands are always dominant over the deciduous species. The pure coniferous stands may be made up of Loblolly Pine alone, but the Scrub Pine is not infrequent, except in the northern part of Worcester County in the vicinity of Berlin, varying in its percentage from 10% in many localities to as much as 60% at some places south of Salisbury. The commonest of the deciduous associates is the Spanish Oak, which is likewise infrequent in the vicinity of Berlin. Only slightly less frequent is the White Oak, while other common species are the Black Oak, the Post Oak, Black Jack Oak, the Willow Oak, Sweet Gum, Pig-nut Hickory, Sassafras and Dogwood. Less frequent are Sour Gum, Red Maple, Holly, Red Cedar, Persimmon and Scarlet Oak.

In Worcester County, where the Sandy Loam areas of the Talbot formation are most extensive, the shrubby vegetation is very variable in its abundance of individuals, exceeding, however, the Clay Upland areas. Characteristic species are: *Vaccinium corymbosum, Azalea nudiflora, Myrica carolinensis, Rhus copallina, Clethra alnifolia, Ilex glabra, Aralia spinosa.* Less frequent are: *Myrica cerifera, Crataegus uniflora, Viburnum prunifolium, Viburnum dentatum, Hamamelis virginiana.*

The herbaceous vegetation is poor in vernal and rich in autumnal species. It is richest in individuals where the forest has the largest admixture of deciduous species, and includes those characteristic of the Clay Upland, together with many found in greater abundance on the Wicomico terrace. The most frequent herbaceous species in Worcester and Wicomico counties are:

Lespedeza repens
Meibomia paniculata
Solidago rugosa

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Baptisia tinctoria
Cracca virginiana
Lechea minor
Eupatorium rotundifolium
Gerardia purpurea
Lespedeza procumbens
Galium circaezans
Meibomia viridiflora
Hieracium venosum
Aster paniculatus
Antennaria plantaginifolia
Pteris aquilina
Panicum microcarpon
Stylosanthes biflora
Ascyrum stans
Chimaphila maculata
Chimaphila umbellata
Asclepias tuberosa
Eragrostis pilosa
Cassia chamaecrista
Aster patens
Polygala mariana.

Less frequent are:

Euphorbia ipecacuanhae
Koellia flexuosa
Meibomia nudiflora
Lobelia inflata
Diodia teres
Houstonia purpurea
Gyrostachys simplex
Elephantopus nudatus
Bradburya virginiana
Anychia dichotoma
Polygala incarnata
Aster ericoides

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Strophostyles umbellata
Senecio tomentosus
Gnaphalium purpureum
Eupatorium hyssopifolium
Chrysopsis mariana
Gymnopogon ambiguus
Polygala nuttallii
Rynchosia erecta
Lobelia nuttallii
Cyperus retrofractus
Polypremum procumbens
Uniola laxa
Sericocarpus asteroides.

SANDY LOAM UPLAND SWAMPS.—The Sandy Loam Upland Swamps are almost entirely confined to Worcester and Wicomico counties, the only portion of the Talbot formation in which there are large continuous areas of light soils. Typical examples may be found in northern Worcester County in a swamp three miles east of Berlin on the divide between Turville and Ayer creeks, and another two miles northwest of St. Martin, on the divide between the St. Martin and Pocomoke rivers. A second type of the Sandy Loam Upland Swamp is found just back of the broad marshes, and may be seen near Boxiron, Greenbackville and elsewhere along Chincoteague Bay in Worcester County. The first of these swamp types is dominated by deciduous trees, the latter by pines; although the proportion of the dominant species is different, the floras of the two types are not very unlike. Where the Loblolly is the chief tree this habitat resembles in physiognomy, and to a slight extent in flora, the moist Pine Barrens of North Carolina, South Carolina and Georgia. The Scrub Pine is invariably absent. The deciduous species make up from 50% to 80% of the stand in the first type and from 10% to 40% in the second type, being made up characteristically of Willow Oak, White Oak, Sweet Gum, Red Maple, Water Oak, Cow Oak, Black Gum, Magnolia, Holly and Dogwood and less frequently of Fringe Tree and the River Birch.

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The floor of the Upland Swamps of the deciduous type is closed by a dense stand of shrubs from three to eight feet in height, among which the most common are: *Myrica cerifera, Viburnum dentatum, Rhus vernix, Pieris mariana, Itea virginica, Aralia spinosa, Aronia arbutifolia, Euonymus americanus.*

In the coniferous type of Swamp the stand of shrubs is much more open, and at many localities in Worcester County is made up almost entirely of *Myrica cerifera,* although the species mentioned above also occur in other places.

The herbaceous vegetation of the deciduous swamps is almost as poor as that of the Clay Upland Swamps, and likewise there is often a carpet of peat moss to be found beneath the dense shade of the shrubs. In the coniferous swamps, however, there is a richer stand of herbaceous plants than in the Upland forests in which the conifers are dominant, and it is here that the resemblance to the southern Pine Barrens is to be noted, to which allusion has been made. Among the most characteristic species are the following:

Rynchospora glomerata
Xyris communis
Rhexia mariana
Drosera intermedia
Osmunda regalis
Cyperus diandrus
Fimbristylis laxa
Juncus dichotomus
Woodwardia areolata
Rynchospora cymosa
Polygala lutea
Hypericum mutilum
Lobelia nuttallii
Fuirena squarrosa var. *hispida*
Rhexia virginica
Habenaria cristata
Diodia virginiana
Bartonia virginica
Drosera rotundifolia

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Woodwardia virginica
Gratiola pilosa
Triadenum virginicum
Rynchospora corniculata
Panicum barbulatum.

THE WICOMICO TERRACE.

UPLAND FOREST.—Extending from northern Worcester County to southern Cecil the area of the Upland of the Wicomico formation presents a striking difference south of Queenstown, Greensborough and Denton and north of these towns. In both regions the Wicomico Upland is the choicest agricultural land of the several counties, and in portions of Queen Anne's and Kent so thoroughly has it been cleared that one may often ride for an hour without seeing any forest whatever. After due allowance has been made for alteration in the character of the forests due to their being in earlier or later stages of reforestation, there is still a very distinct difference between the coniferous forests of the southern counties and the purely deciduous forest of the region lying north of the towns just mentioned. These will be discussed separately.

Coniferous Upland Forest.—These forests are well within the range of the Loblolly Pine, and are made up of that tree together with the Scrub Pine in varying percentages of admixture. The pines may form from 60% to 100% of the stand, decreasing in their dominance with age, but never disappearing from their association with the deciduous trees in the oldest stands. The commonest of the deciduous trees in this type of forest are the White Oak and the Spanish Oak, which together seldom form less than 75% of the deciduous element. Other associates are the Black Oak, Sweet Gum, Sassafras, the Black Jack Oak, the Pig-nut Hickory, the Mocker-nut Hickory, the Willow Oak, the Black Gum and the Persimmon. Among the infrequent trees in this forest are the Scarlet Oak, the Post Oak, the Beech and the Red Maple. The Chestnut is noticeably rare.

The variable stand of shrubs is made up of: *Gaylussacia resinosa, Vaccinium corymbosum, Rhus copallina, Myrica carolinensis, Viburnum prunifolium* and *Cornus florida.*

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FIG. 1.—VIEW SHOWING A SMALL SAND DUNE FIXED BY A GROWTH OF SAND REED, NEAR OCEAN CITY, WORCESTER COUNTY.

FIG. 2.—VIEW SHOWING FARMING SCENE, NEAR LEONARDTOWN, ST. MARY'S COUNTY.

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The herbaceous vegetation is much the same as that which has already been listed for the Clay Upland forests, and like it is poor in individuals.

Throughout the greater part of Caroline and Queen Anne's counties the Scrub Pine is more conspicuous than the Loblolly in the first stage of reforestation, and there are many stands of Scrub Pine north of Denton and Greensborough, that is, within the deciduous forest area, but these are all destined to become replaced by purely deciduous forest in the course of time.

Deciduous Upland Forest.—The Deciduous Upland Forests of the Wicomico formation in Queen Anne's, Kent and southern Cecil counties are made up in part of the same species which accompany the pines in the coniferous forest of the lower counties, but a few new species are encountered here, such as are of much greater abundance in the Midland Zone, and a few species which are quite rare in the lower counties now become important constituents of the forest. The most noticeable addition to the forest flora is the Chestnut, and the most noticeable change in relative abundance is that which brings the Hickories to the fore as very important constituents of the oldest stands of forest.

In a grove about 40 years old three miles west of Chestertown, Kent County, the Mocker-nut Hickory, the Pig-nut Hickory and the Bitter-nut Hickory formed 55% of the forest stand, the Black Oak 20%, the Spanish Oak 10% and the Willow Oak, the Sweet Gum and the Black Gum 5% each. A second stand was examined near Schenk Corners, Queen Anne's County, in which the Hickories did not predominate, the percentage of the various trees being as follows:

Chestnut	22%
White Oak	15
Willow Oak	12
Black Oak	10
Sweet Gum	10
Spanish Oak	8
Scarlet Oak	6
Mocker-nut Hickory	4

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Red Maple	4
Black Gum	4
Post Oak	2
Swamp Oak	2
Miscellaneous	1

The character of the undergrowth and herbaceous vegetation in the forests of the Wicomico Upland depends upon the surface soil conditions, which are in turn dependent upon the stage of reforestation that has been reached. The subordinate vegetation is divisible into a more xerophilous set characterising the earlier stages of reforestation, in which the soil is more exposed to the sun's rays, and a more hygrophilous set which characterise the shade of the later stages of the forest.

Among the commonest of the xerophilous set are:

Potentilla canadensis
Antennaria plantaginifolia
Hieracium venosum
Meibomia obtusa
Cassia chamaecrista
Cracca virginiana
Meibomia viridiflora
Solidago nemoralis
Nabalus albus
Lespedeza hirta
Galium circaezans
Panicum depauperatum
Sericocarpus asteroides
Lechea minor
Pyrola rotundifolia
Polygala cruciata
Meibomia michauxii
Muhlenbergia diffusa
Euphorbia corollata
Ceanothus americana
Eupatorium verbenaefolium

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Apocynum androsaemifolium
Hieracium scabrum
Eatonia nitida
Polygala verticillata
Kneiffia fruticosa.

The most characteristic of the hygrophilous species are:

Aster puniceus
Aster cordifolius
Solidago caesia
Viola lanceolata
Geum canadense
Lobelia inflata
Ranunculus abortivus
Scrophularia marylandica
Senecio aureus
Steironema ciliatum
Eupatorium perfoliatum
Vernonia noveboracensis
Uvularia sessilifolia
Medeola virginiana
Asplenium filix-foemina
Collinsonia canadensis
Polygala mariana
Linum virginianum
Polygonatum biflorum
Oxalis stricta
Penthorum sedoides

Ravine Slopes.—The Ravine Slopes of the Wicomico terrace fall into two distinct groups, those with gravel soil and those with loam or sandy loam soil. The former are the slopes of the beach of the Talbot sea, the latter are slopes due to erosion on the Wicomico formation. On the gravel Ravine Slopes the Chestnut and the Chestnut Oak are the dominant trees from the vicinity of Denton and Wye Mills northward. The White and Black Oaks are the dominant spe-

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cies southward, and are associated with the Chestnut and Chestnut Oak in the upper Eastern Shore. The shrubby vegetation is commonly made up of thickets of Laurel (*Kalmia latifolia*) and the most common of the scattered herbaceous plants is *Deschampsia flexuosa*. On the loam Ravine Slopes is to be found a much richer flora, in which the principal trees are the Beech, the White Oak, the Buttonwood, the Spanish Oak, the Pig-nut Hickory, the Red Mulberry, the Wild Black Cherry, the Hackberry, the Holly and rarely the Red Oak and the Loblolly Pine. Very infrequent is the Linden (*Tilia americana*), which is not known outside this habitat on the Eastern Shore. Another tree common in the Upper Midland District and Mountain Zone which is known only from a single station on the Eastern Shore is the Hemlock (*Tsuga canadensis*), which is found on the Ravine Slopes of Watts Creek in Caroline County, three miles south of Denton. A number of shrubs and herbs have been seen in Ravine Slope forests which are very rare or unknown in other habitats on the Eastern Shore, including *Corylus americana, Vagnera racemosa, Salvia lyrata, Heuchera americana, Asarum canadense, Aristolochia serpentaria, Phegopteris phegopteris* and *Polypodium vulgare*.

It must be noted here that there are a few localities on the Talbot terrace where it has undergone considerable erosion and presents limited areas of Ravine Slope and Flood Plain. This is true of the broader parts where it attains the greatest elevation adjoining the Wicomico, as in Windmill and Peachblossom branches south of Easton, Talbot County. In this region the vegetation of the Slopes and Flood Plains on the Talbot terrace is identical with that on the Wicomico.

Flood Plains.—In many of the Flood Plains of the Wicomico terrace the average soil moisture content is near saturation, in others it is much less, but in even the lowest it ranges much higher than in any of the upland soils. The forest is entirely deciduous, in the wetter Flood Plains it resembles that of the Stream Swamps to be described later, in the drier it resembles the Flood Plain forests of the Midland Zone.

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A typical example of the wet type of Flood Plain has been examined along Miles Creek, about three miles east of Trappe in southern Talbot County, where the predominant trees are the Red Maple, Black Gum, White Ash, Winterberry and Magnolia. The shrubs are: *Clethra alnifolia, Alnus rugosa, Viburnum dentatum, Cephalanthus occidentalis and Rhus vernix.* Characteristic herbaceous species are: *Saururus cernuus, Osmunda cinnamomea, Onoclea sensibilis, Chrysosplenium americanum, Chelone glabra, Triadenum virginicum, Impatiens biflora, Viola blanda, Ranunculus sceleratus, Carex intumescens* and *Galium triflorum.*

The forest of the drier Flood Plains bears less resemblance to the Stream Swamps, as the trees are of larger stature, the Red Maple and Black Gum are less abundant, and the Winterberry and Cephalanthus are rare: The predominant trees are the Tulip Tree, the Elm, the Sweet Gum, the White Ash, the Buttonwood, the Hornbeam, the Willow Oak, Red Maple and Black Gum. Characteristic shrubs and herbs are: *Benzoin benzoin, Viburnum dentatum, Euonymus americanus, Botrychium virginianum, Homalocenchrus virginicus, Polygonatum biflorum, Arisaema triphyllum, Viola blanda, Aster puniceus, Oxalis stricta.*

At several places along Marshyhope Creek in the vicinity of Federalsburg, Caroline County, there are sandy Flood Plains which are of more recent formation than the Talbot terrace and abut directly upon the Wicomico Upland. They are markedly different from the Upland Flood Plains of the Wicomico formation, and are related on the one hand to the Sandy Loam Upland Swamps and on the other to the Stream Swamps which are to be subsequently described. The commonest trees are the Loblolly Pine and the Water Oak; abundantly represented are the Holly, the Black Gum, the Magnolia, the White Ash, the Fringe Tree, the Dogwood and the Hornbeam. The shrubby and herbaceous vegetation includes *Clethra alnifolia, Viburnum dentatum, Azalea nudiflora, Euonymus americana, Mitchella repens, Carex intumescens, Carex laxiculmis* and *Carex folliculata.* Lianes are abundant, including *Smilax rotundifolia, Parthenocissus quinquefolia, Vitis labrusca, Tecoma radicans* and *Dioscorea villosa.*

These Flood Plains are of interest because of their being (together with the Sandy Loam Upland Swamps) the only forested

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moist sandy habitats of the Eastern Shore, and because of the southern range of their predominant species. They differ from the Upland Swamps in the absence of the Pine Barren class of herbaceous plants, and they differ from the Stream Swamps in the absence of the Red Maple, the Winterberry and several of their associates. The Hornbeam is an uncommon tree in the Coastal Zone, where it is found only in Flood Plains, and it is a striking fact that it here occurs in the same habitat with several trees of southern range which are not found outside the Coastal Zone.

Upland Swamps.—The Upland Swamps of the Wicomico terrace are found only in northern Caroline County and the north-eastern part of Queen Anne's County in the vicinity of Marydel, Barclay and Sudlerville. The soils are chiefly sandy loams and silt loams of the Norfolk and Portsmouth series, with a high content of organic matter and rendered acid by the poor drainage. The arborescent flora is distinctly different from that of the Sandy Loam Upland Swamps, and more nearly related to that of the Clay Upland Swamps. Its trees are Black Gum, Swamp Oak, Red Maple, Sweet Gum, Willow Oak and White Oak, all of which appear to occur in about equal abundance. Holly, Beech, Magnolia and the Swamp Poplar are infrequent. The shrubs and herbs of these Upland Swamps resemble those of the River Swamps, among the most notable species being *Itea virginica, Aronia arbutifolia, Azalea viscosa* var. *glauca, Polygonum amphibium, Utricularia inflata* and *Proserpinaca palustris.*

Swamp Vegetation.

RIVER SWAMPS.

The River Swamps are characterized chiefly by the occurrence of the Bald Cypress, which is in all places the dominant tree, occuring in some localities in almost pure stands. Outside the margins of the Pocomoke River and its two chief tributaries the Bald Cypress occurs in Upland Swamps in a few localities in Worcester County, is frequent along the Wicomico River, and is known from two localities in the Western Shore District of the Coastal Zone.

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The Cypress first appears in ascending the Pocomoke River at Cedar Hall Landing, and a few small trees are to be seen opposite Rehoboth on the outer edge of the broad brackish marsh. At a point about a mile and a half above Rehoboth the brackish marsh terminates abruptly and the River Swamps occupy the margins of the river. The narrowness and deepness of the Pocomoke are not favorable to the occurrence of extensive pure stands of Cypress, and at most localities there are several other tree species associated with it. The characteristic peculiarities of the Cypress, the swollen base of the trunk and the "knees," are not very markedly developed in the second growth trees along the Pocomoke, but may be observed in the trees of the pure stand in Newhope Pond, an old artificial millpond near Willard, which is crossed by the Baltimore, Chesapeake and Atlantic Railway. Below Mattaponi Landing there is no emersed aquatic vegetation outside the Swamp, but there are a few places on the convex sides of the river where there are narrow zones of such plants as are characteristic of the Fresh Marshes. Above Mattaponi a zone of *Nymphaea advena* and *Pontederia cordata* is almost continuous along the outer margin of the Swamp.

The River Swamp occupies a narrow shelf which rises as one advances from the river back toward the Upland, and decreases in the frequency of inundation by the fluctuating level of the river. It is in the outer zone of the Swamps that the Cypress is most abundant, the inner zone often bearing a near resemblance to the Sandy loam Upland Swamps. The most abundant associates of the Cypress are Black Gum, Red Maple, Sweet Gum, Tupelo, Green Ash and Magnolia. Less abundant are Tulip tree, Winterberry, Hornbeam, Swamp Poplar, Water Oak and White Cedar. In the inner zone of the Swamps the Loblolly Pine, White Oak and Holly also occur, the Cypress becomes less abundant and the Black Gum, Red Maple and Sweet Gum more so.

The undergrowth of the River Swamps is usually rather thick and is rich in species. Frequent and characteristic are:

Myrica cerifera
Clethra alnifolia
Xolisma ligustrina

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Alnus rugosa
Cephalanthus occidentalis
Cornus amomum
Viburnum dentatum
Pieris mariana
Decodon verticillatus
Gaylussacia frondosa.

The woody climbers are conspicuous by their abundance, and interesting as comprising two southern forms here near the northern limit of their range,—the last named.

Tecoma radicans
Vitis labrusca
Vitis aestivalis
Smilax rotundifolia
Parthenocissus quinquefolia
Rhus radicans
Vitis rotundifolia
Bignonia crucigera.

Within the Swamp the herbaceous vegetation is very poor in individuals and comprises:

Hypericum mutilum
Impatiens biflora
Hydrocotyle umbellata
Triadenum petiolatum
Dryopteris thelypteris
Lobelia cardinalis
Dulichium arundinaceum
Isnardia palustris
Proserpinaca palustris
Saururus cernuus
Boehmeria cylindrica
Penthorum sedoides
Lycopus virginicus
Carex lupuliformis

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FIG. 1.—VIEW SHOWING EROSION ON WEST SHORE OF CHESAPEAKE BAY, NEAR FAIRHAVEN, ANNE ARUNDEL COUNTY.

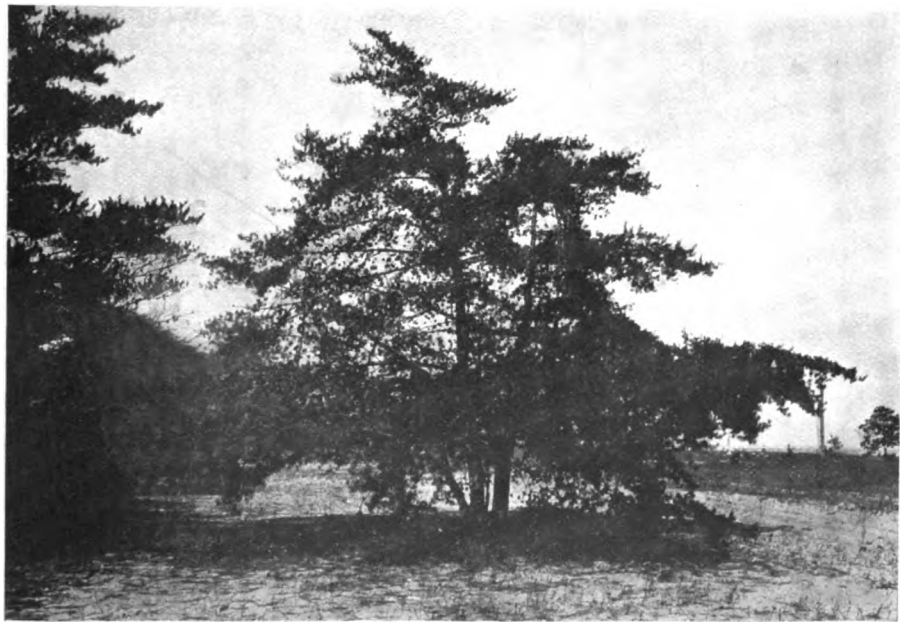

FIG. 2.—VIEW SHOWING CHARACTER OF SCRUB PINE IN OPEN GROWTH, NEAR COVE POINT, CALVERT COUNTY.

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STREAM SWAMPS.

Stream Swamps are found throughout the Talbot terrace along non-tidal fresh streams, along the headwaters of the longer rivers, around millponds and in the zone between Fresh Marshes and the Upland. Their place is taken on the Wicomico terrace by the Flood Plain forest, to which they bear some resemblances as well as to the River Swamps. They are widely distributed in Dorchester County along Transquaking, Little Blackwater and Chicacomico rivers and elsewhere. The most northerly point at which a typical Stream Swamp has been seen is at Howell Point, in Kent County, where there is a small area lying back of a Fresh Marsh.

The trees of the Stream Swamps are a mixed stand of deciduous species of small and irregular stature, the shrubs are numerous, and the herbaceous vegetation richer than in any other type of swamp in the state. The Loblolly Pine and the White Cedar are present in certain of the swamps, but never become so abundant as to destroy the characteristic physiognomy, and neither does their presence correspond with differences in the accompanying vegetation. It appears, in other words, that the River Swamps of the Pocomoke occupy an area in which the physical conditions are not sufficiently different from those in the Stream Swamps to explain the differences in flora between the two, and neither does the abundant presence of the White Cedar in the River Swamps modify the plant assemblage away from the character of the purely deciduous swamps, or toward the character of the River Swamps.

The most common deciduous species of the Stream Swamp are the Red Maple, the Winterberry and the Green Ash. In most of the swamps of Dorchester and Talbot counties, and in that at Howells Point, the first of these is dominant; in several swamps at the head of short tributaries of the Choptank the second is most abundant; while along the headwaters of the Choptank River the last-named is far more abundant than both the others. The Loblolly is conspicuous as an associate of these trees only on the upper waters of the Choptank and Nanticoke, where it occupies isolated elevated situations and does not occur along the margin of the river. The White Cedar is infrequent in the swamps of the Wicomico; on

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the Nanticoke it begins to occur just north of Vienna and becomes abundant at the confluence of Marshyhope Creek, extending thence up the river to Seaford, Delaware and beyond. The White Cedar, unlike the Loblolly, occupies the lowest parts of the swamp and is indeed most frequent along the very margin of the water. The only plant which has been detected as a constant associate of the Cedar and absent from other portions of the Stream Swamps is *Alnus maritima,* a fall-flowering species of Alder which is probably endemic to the Chesapeake-Delaware peninsula. The commonest of the secondary trees are the Black Gum, Magnolia, Sweet Gum and Black Willow; the Swamp Oak and the River Birch being present in the swamps which border some of the smaller streams. The commonest shrubs are *Clethra alnifolia, Alnus rugosa, Cephalanthus occidentalis, Decodon verticillatus, Cornus amomum, Itea virginica, Rhus vernix, Viburnum dentatum.*

These form a close stand together with some of the larger of the herbaceous plants, the whole often forming thickets which are difficult to penetrate. The herbaceous plants are altogether more sun-loving species than those found in the River Swamps. Among the most characteristic may be mentioned:

Rosa carolina
Carex prasina
Typha latifolia
Osmunda cinnamomea
Impatiens biflora
Saururus cernuus
Osmunda regalis
Sagittaria latifolia
Cicuta maculata
Rumex verticillatus
Peltandra virginica
Pontederia cordata
Vernonia noveboracensis
Polygonum hydropiper
Iris versicolor

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Proserpinaca palustris
Thalictrum purpurascens
Viola cucullata
Boehmeria cylindrica.

Marsh Vegetation.

The Marshes of the Eastern Shore aggregate many acres in area, being most extensive in Dorchester and Somerset counties around Tangier Sound, occupying considerable areas along the shores of all

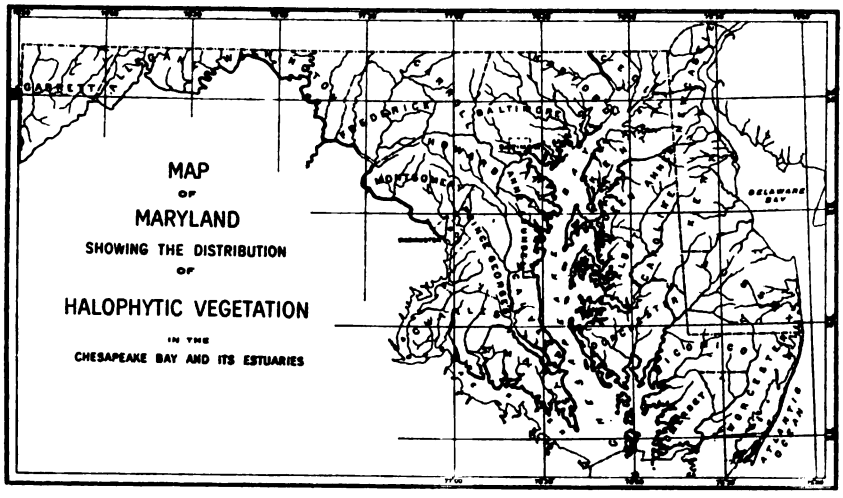

Fig. 5.—Map of Maryland showing the distribution of Halophytic Vegetation in Chesapeake Bay and its estuaries.

the larger estuaries, following far up the longer rivers and around the shores of Chincoteague Bay on the ocean front. On Tangier Sound the marshes are pronouncedly salt, as they are on all of the larger estuaries of the southern part of the Bay, while in the rivers at the head of the Bay they are entirely fresh. The transition from Salt Marshes to Fresh Marshes may be observed not only along the open waters of the Chesapeake in passing from the Capes to the mouth of the Susquehanna, but also in passing up any of the longer rivers emptying into the lower Bay, or in passing toward the upland over any of the extended areas of Marsh on Tangier Sound. The

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gradual nature of all these transitions makes somewhat artificial an attempt to treat the two classes of Marshes separately.

The topography of the upland determines largely the extent of the Marshes. Where there is a very gradual shelving of the surface from below tide level to a flat upland there are the largest marshes, as in southern Dorchester County, where one may pass from the shores of Fishing Bay over three to five miles of Marsh before reaching the upland. In such localities may be observed the transition from Salt to Fresh Marsh above noted, while the narrower fringes of Salt Marsh abut directly upon a higher upland without intervening Fresh Marsh. On the Choptank River, Eastern Bay and Chester River and their tributaries the Salt Marshes are not extensive, while in the Sassafras, Bohemia, Elk and North East rivers the halophytic element is almost entirely absent.

The usual precession of plant habitats observed in passing up one of the longer rivers of the Eastern Shore, as the Nanticoke or Choptank, is (1) Salt Marsh abutting directly upon the upland, (2) Salt Marsh with Fresh Marsh lying between it and the upland, (3) Fresh Marsh abutting upon the upland, (4) Fresh Marsh with Stream Swamp lying between it and the upland, (5) Stream Swamp. The Fresh Marshes which border the longer rivers have a rich flora which is very diverse in the grouping of its species, while the Fresh Marshes that lie back of the broad areas of Salt Marsh are more like the Salt Marshes superficially, in the simplicity of their flora and the uniformity in the grouping of the species from place to place. The Fresh Marshes occupy but a small part of the course of the Pocomoke River, from Shelltown to Rehoboth, where they give way to River Swamps. On the Nanticoke they extend from Roaring Point to Riverton, and on the Choptank from Jamaica Point to the confluence of Tuckahoe Creek. The water of the great lagoon of Worcester County is brackish only in its lower half,* becoming fresh on passing north of Ricks Point into Newport, Sinepuxent, Isle of Wight and Assowoman bays.

*See Ducatel, Outlines of the Physical Geography of Maryland. Trans. Maryland Academy Science and Literature, Vol. I., 1837, pp. 24-54.

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SALT MARSHES.

The pronouncedly Salt Marshes are found along estuaries in which the water is salt, from just within the level of the lowest neap tides up to a point somewhat above that reached by mean high tide. These marshes bear a very uniform physiognomy due to the predominance of *Spartina stricta* var. *maritima.* The outer parts of the Salt Marshes, subject to the most prolonged inundation, are pure stands of *Spartina,* while in the inner portions there are associated with it some of the more salt resisting plants of the halophytic flora, as *Salicornia herbacea, Tissa marina, Atriplex hastata,* and *Aster tenuifolius.* Passing toward the upland on the areas which are above mean high tide but subject to overflow at spring tide and other exceptional tides, is found a type of Marsh in which *Spartina stricta* var. *maritima* is absent and *Spartina patens* and *Distichlis spicata* form a low turf of finer texture which, by reason of the density of its stand, possesses usually as few accompanying species as does the outer zone. Of these the commonest are *Aster tenuifolius, Aster subulatus, Juncus gerardi, Gerardia maritima, Pluchea foetida, Pluchea camphorata.* Behind the narrowest of the *Spartina stricta* zones the *Spartina patens* zone is not found; where there is a less rapid transition to the upland and along the transition zone in the longer rivers it reaches its best development. There are frequent depressions in the general level of the marsh that have been rendered so salt by successive inundation and evaporation that they are occupied only by *Salicornia* or are sometimes entirely bare. With this exception there is little to break the uniformity of the plant covering.

The physical features of Salt Marshes and the physiology of their vegetation have been fully discussed by Kearney* for the lower Chesapeake, and the conditions are practically identical in the Salt Marshes of the portions of the Bay lying in Maryland.

*Kearney, Thomas H., A Botanical Survey of the Dismal Swamp Region. Cont. Nat. Herb., Vol. V., 1901.

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FRESH MARSHES.

The areas of Fresh Marshes which have been examined on the longer rivers of the lower Chesapeake Bay exhibit a close agreement on the Pocomoke River opposite Rehoboth, on the Nanticoke at Vienna and on the Choptank in the vicinity of Dover Bridge. The spring aspect of the Marshes is monotonous, and the summer months are the period of greatest vegetative activity. It is only in September that one may gain an adequate idea of the richness of the flora, and from then until frost the marshes are conspicuously beautiful, the varied shades of green being softened to rich browns, and brightened by the yellow and purple flowers of *Bidens* and *Vernonia*.

The extreme outer margin of the marshes is formed by *Nymphaea advena*, and adjacent to it is a zone in which are also such emersed aquatics as *Peltandra virginica, Pontederia cordata, Sagittaria latifolia* and *Scirpus lacustris*. In this outermost zone *Hibiscus moscheutos* sometimes occurs in great abundance, or in a few places where there are natural dykes along the outer edge of the marsh and along one side of the streamways through it, *Baccharis halimifolia* may be found, as on the Nanticoke about four miles south of Vienna.

The one fresh water plant which is more capable than any other of resisting brackish conditions is *Scirpus americanus*. Only slightly less so are *Scirpus olneyi, Scirpus robustus, Spartina polystachya* and *Zizania aquatica*. These species are the first that are encountered in passing up stream out of the purely halophytic marshes, and *Spartina stricta* var. *maritima* and *Spartina patens* soon give way to stands in which one or another of these is dominant, for they are never associated in a uniform admixture over areas of any extent. There are no observable differences in physical conditions to account for the sporadic occurrence and distribution of the stands of these several plants, which appear to be ecologically equivalent and to dominate or give way according to the chance conditions of reproduction by either seeds or rootstocks. The only other species which form pure stands with any frequency are *Phragmites phragmites*, which is however, not at all a common grass in the marshes, although it is confined to them in its occurrence in Maryland, and

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Typha angustifolia, which is not as abundant in the larger fresh marshes as it is in those of the estuaries at the head of the Chesapeake.

Outside pure stands the species above mentioned also occur sporadically in portions of the marshes in which a number of other species of the same stature grow. While the flora of any square rod of such areas of Fresh Marsh would be the same as that of any other square rod, yet there are not only no two square rods but scarcely any two square yards that would show the same species present in anything like the same proportional abundance. The life conditions are here such as favor a large number of species; the total flora is made up of herbaceous plants,—save for *Hibiscus* and *Baccharis,*—and each growing season witnesses a new shifting and a new readjustment of the elements of the vegetation. Most prominent among the species of highest stature in the Fresh Marshes are:

Vernonia noveboracensis
Asclepias pulchra
Bidens trichosperma var. *tenuiloba*
Eryngium virginianum
Eupatorium perfoliatum
Acnida cannabina
Helenium autumnale
Impatiens biflora
Carex lurida
Panicum walteri
Lobelia elongata
Carex crinita
Carex albolutescens
Sagittaria latifolia
Cyperus flavescens
Juncus effusus
Pontederia cordata
Sium cicutaefolium
Kosteletzkya virginica
Sagittaria lancifolia
Solidago sempervirens.

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Growing among the above species is an equally rich and diversified association of plants of subordinate stature. Few of these are found in any considerable numbers in the pure stands of the Fresh Marsh, but in the mixed stands they are abundant, and particularly so in the inner portion of the marshes next the mainland, where the stature of the dominant species is much less. These species are:

Ptilimnium capillaceum
Hypericum mutilum
Hydrocotyle umbellata
Polygonum hydropiperoides
Lippia lanceolata
Juncus canadensis
Epilobium coloratum
Dryopteris thelypteris
Sabbatia stellaris
Sabbatia dodecandra
Juncus acuminatus
Cyperus nuttallii
Iris versicolor
Oxypolis rigidus
Hypericum canadense
Willughbaea scandens
Galium triflorum
Triadenum virginicum
Polygonum sagittatum
Polygonum arifolium
Proserpinaca palustris
Aeschynomene virginica
Stachys ambigua
Samolus valanderi
Lysimachia terrestris.

On all of the Fresh Marshes which extend from the river to the upland the stature of the vegetation gradually decreases from about six feet to a low turf only a few inches in height. The Salt Marsh grasses *Spartina patens* and *Distichlis spicata,* occasionally extend

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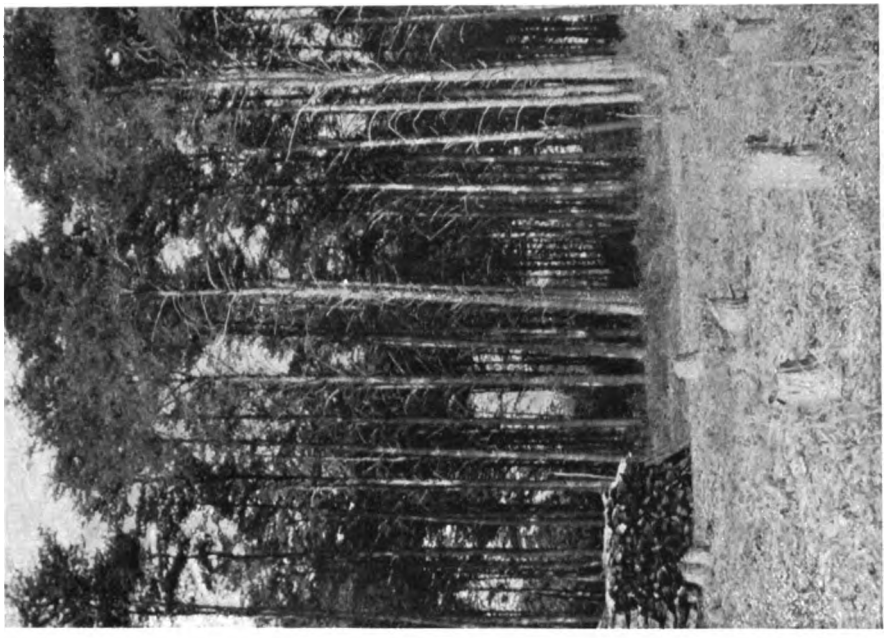

FIG. 2.—VIEW SHOWING SECOND GROWTH OF SCRUB PINE, ST. MARY'S COUNTY.

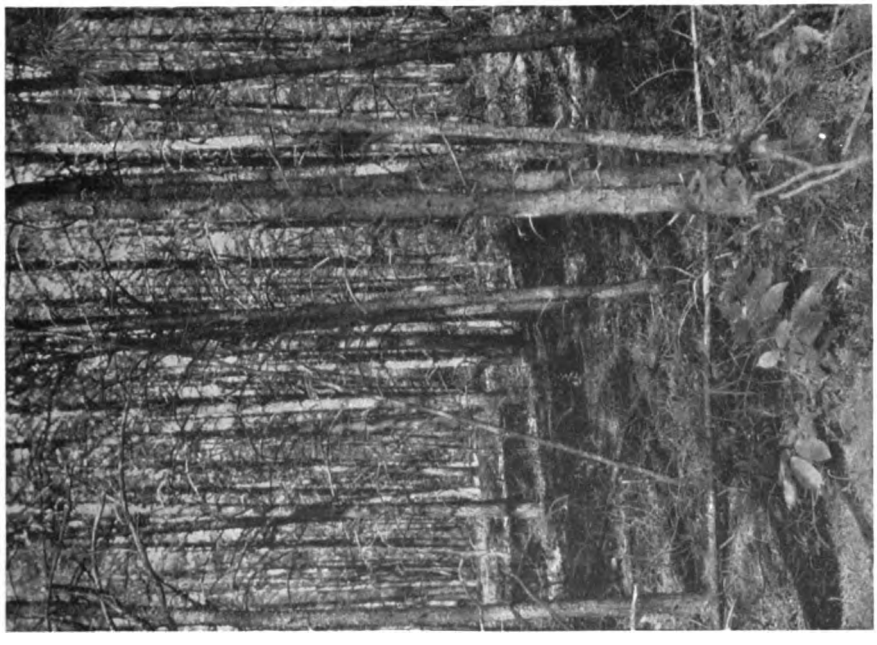

FIG. 1.—VIEW SHOWING SECOND GROWTH OF LOBLOLLY PINE, ST. MARY'S COUNTY.

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up stream into the fresh water zone as constituents of this turf. The soil which underlies it is not the pure Galveston clay, as the black muck of the Marshes proper has been designated by the Soil Survey, but contains a great deal of sand, and the vegetation correspondingly comprises some of the herbaceous species of the Sandy Loam Upland Swamps, as *Rynchospora glomerata, Xyris communis* and *Rhexia mariana.* In addition to these are such forms as *Eriocaulon decangulare, Fimbristylis castanea, Cladium mariscoides, Erianthus compactus, Panicum virgatum, Proserpinaca palustris* and *Hydrocotyle ranunculoides.*

Just outside the Fresh Marshes there is frequently a narrow strip of muddy shore unoccupied by large perennial vegetation and subject to alternate submergence and exposure. At a few localities these tidal mud flats have been found to bear a sparse growth of small forms, most of which are known only in such habitats, and all but the first two of which are quite uncommon:

Eleocharis acicularis
Lilaeopsis lineata
Sagittaria subulata
Elatine americana
Lophotocarpus spongiosus
Sagittaria engelmanniana
Limosella tenuifolia
Micranthemum micranthemoides
Sagittaria graminea
Isoetes saccharata.

The Fresh Marshes which lie in the transition zone between the broad areas of Salt Marsh and the upland in southern Dorchester County present an extremely uniform aspect over thousands of acres, as seen at Keene Ditch and at several localities near Bestpitch Ferry. The soil of the Marshes at these places is in a constant state of saturation, is inundated at the time of the highest tides, and is a black muck of the Galveston Clay type. The vegetation is a pure stand of *Scirpus olneyi* in many localities, or in others a mixture of it and *Scirpus americanus.* There is an extremely sparse

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accompaniment of species such as are also found in the Fresh Marshes of the rivers, as: *Scirpus lacustris, Asclepias pulchra, Sium cicutaefolium, Hibiscus moscheutos, Bidens trichosperma* var. *tenuiloba, Ptilimnium capillaceum, Lysimachia terrestris.*

In the vicinity of Greenbackville, Worcester County, the Salt Marshes of *Spartina stricta* var. *maritima* and *Spartina patens* form the outer margin of the marshland. Following up any of the numerous small streams which flow off the upland in this locality there is a rapid transition to Fresh Marsh (See Plate VI, Fig. 2), in which *Scirpus olneyi* is often the only conspicuous plant, or in which *Scirpus olneyi, Scirpus americanus, Scirpus robustus* and *Typha angustifolia* are intermingled or occur in groups. The species which are of subordinate importance in these Marshes are partly of the same stature as the species mentioned, as *Lythrum lineare, Eryngium virginianum,* and *Kosteletzkya virginica.* Of smaller stature and frequent occurrence are *Samolus floribundus, Hydrocotyle umbellata,* and *Sabbatia dodecandra.* On passing toward the upland the Marsh merges rapidly into a sandy bog, suggesting the inner sandy areas of the river marshes but much more pronouncedly unlike the Fresh Marshes themselves. There are scattered clumps of *Alnus rugosa* with herbaceous vegetation comprising:

Drosera intermedia
Rynchospora alba
Rynchospora glomerata
Triadenum virginicum
Fuirena squarrosa var. *hispida*
Hypericum mutilum
Rhexia mariana
Xyris communis
Triglochin striata
Lycopodium inundatum
Eryngium virginianum
Nymphaea advena
Utricularia juncea.

The Fresh Marshes in the vicinity of Ocean City and Turville Creek are much richer in species than those near Greenbackville.

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Their outer margins are of the *Spartina stricta* type or of the *Scirpus olneyi* type. Within, they are of a character intermediate between Fresh Marshes and Bogs, but somewhat drier than either. These areas lie above the reach of tides, the soil is a coarse sand, never saturated but always moist, the vegetation is sparse and open and at a few places near the upland seedlings of Loblolly Pine are gaining a foothold. These "heaths" would appear to have come about through the building up of bogs, such as have been described for the vicinity of Greenbackville, by sand from the upland transported by surface drainage. They are traversed by slow streams and have more moist sections resembling the ordinary Fresh Marshes and drier sections resembling bogs. Characteristic of the moist parts are:

Scirpus robustus
Fimbristylis castanea
Gerardia maritima
Cyperus nuttallii
Asclepias pulchra
Juncus canadensis
Sabbatia stellaris
Eryngium virginianum
Hydrocotyle ranunculoides
Hydrocotyle canbyi.

Characteristic of the drier parts are:

Lobelia nuttallii
Linum medium
Drosera intermedia
Euthamia graminifolia
Strophostyles helvola
Polygala mariana
Asclepias lanceolata
Cassia nictitans
Eupatorium hyssopifolium
Sericocarpus linifolius
Centella asiatica

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Tripsacum dactyloides
Lycopodium inundatum
Habenaria ciliaris
Paspalum floridanum.

Along the shores of Eastern Bay there are numerous narrow bodies of Salt Marsh. On entering the short estuaries, as Wye and Miles rivers the transition to Fresh Marsh is found to be very rapid, only a few such forms as *Solidago sempervirens, Hibiscus moscheutos, Kosteletzkya virginica* and *Acnida cannabina* making their way from the brackish water zone into the heads of the branch estuaries. On the Chester River the Salt Marshes are confined to the shores south of the mouth of Corsica Creek, while in the vicinity of Chestertown and Centreville the marshes are fresh.

The Fresh Marshes found from Eastern Bay northward are less variable in character and not so rich in their flora as those of the longer rivers from the Choptank southward. There are frequently extended pure stands of *Typha angustifolia,* as on Corsica Creek in the vicinity of Centreville, or pure stands of *Zizania aquatica* or of *Spartina polystachya* as in several reentrants near Perryville, Cecil County, or less frequently *Acorus calamus* forms considerable areas of the marsh, as in Elk River, and is indeed seldom found outside these pure stands. On Morgan Creek, in Kent County, there is a pure stand of *Typha angustifolia* on one side of the creek and a pure stand of *Zizania aquatica* on the other, the difference in the occurrence of the two being apparently related to the slightly higher level of the Marsh on the *Zizania* side.

In the mixed Fresh Marshes of the Elk and Northeast rivers there are a few forms to be found which do not occur outside the marshes of tidal streams, but many of them are such as are also characteristic of the marsh-like habitats of the upland—meadows, the margins of streams, etc. Of these the principal species are:

Typha angustifolia
Spartina polystachya
Zizania aquatica
Acorus calamus

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Scirpus americanus
Acnida cannabina
Helenium autumnale
Bidens trichosperma var. *tenuiloba*
Cicuta maculata
Impatiens biflora
Sium cicutaefolium
Solidago sempervirens
Scirpus polyphyllus
Polygonum hydropiper
Rudbeckia laciniata
Galium triflorum
Ilysanthes dubia
Bidens laevis
Sagittaria variabilis
Pontederia cordata
Carex lurida
Homalocenchrus oryzoides.

The accompanying outline map (Fig. 6) will serve to illustrate the rapid transition from brackish to fresh vegetation in the estuaries of the central part of the Chesapeake Bay. The area is at the

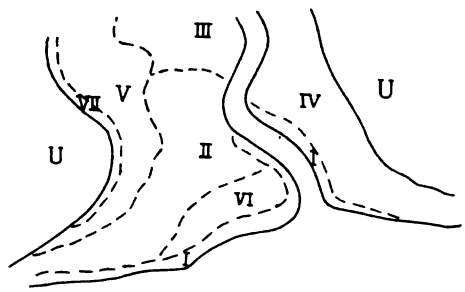

FIG. 6.—Diagram of the Plant growth near Probasco's Landing, Talbot County.

mouth of a small stream which flows into Skipton Creek, Talbot County, in the near vicinity of Probasco's Landing. The position of the upland is indicated by *U U*. Area *I.* is a fringe of *Spartina polystachya, Aster tenuifolius, Pluchea camphorata, Polygonum*

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acre, Acnida cannabina, and *Lythrum lineare.* Area *II.* is above mean tide-level and bears a turf of *Spartina patens.* Scattered individuals of depauperate *Spartina polystachya* occur in the outer margin of area *II.* and along the stream are a few plants of *Acnida cannabina.* In area *VI.* there is considerable *Distichlis spicata* intermingled with *Spartina patens.* Area *III.* is a mixed stand of *Typha angustifolia, Scirpus robustus* and *Acnida.* Areas *IV.* and *V.* are stands of *Typha angustifolia* with *Polygonum acre* and *Sium cicutaefolium.* Area *VII.* is the characteristic marginal zone of *Hibiscus moscheutos* and *Baccharis halmimifolia.*

Aquatic Vegetation.

The waters of the Chesapeake Bay and the larger estuaries contain a relatively poor algal flora as compared with those parts of the Atlantic coast where there are rocks and boulders serving as points of attachment. Species of *Ulva, Enteromorpha* and *Cladophora* are the commonest Green Algae along the shores and in the shallower waters. The Brown Algae are represented chiefly by *Ectocarpus,* and the Red Algae by several species of *Ceramium* and by *Dasya elegans.* The Phanerogamic aquatics of salt water are only two in number, *Zostera marina,* which is most abundant along the shores of Chincoteague Bay and the lower Chesapeake, where the water is violently agitated by the waves; and *Ruppia maritima.* which is abundant on muddy bottoms in shoal water not only in salt water but in brackish and fresh parts of the longer estuaries.

The Phanerogamic aquatics are much more abundant in the fresh waters about the head of the Bay and in the Chester, Sassafras, Bohemia, Elk and North East rivers. The commonest of these is *Vallisneria spiralis,* which under the name "Wild Celery" is well known as an important food-plant of the wild duck. *Vallisneria* is extremely abundant in the shallow waters about the head of the Bay, where, at low tide, the floating ends of the ribbon-like leaves betray its presence over areas many acres in extent. *Potamogeton crispus* is often associated with *Vallisneria,* and has been noticed to be particularly abundant in the Chester and Sassafras rivers. These aquatics grow where they are subjected to the pull of strong

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tidal currents, which they are structurally well fitted to withstand. In more protected situations *Myriophyllum humile, Potamogeton pectinatus* and *Naias flexilis* occur, while in the quite shoal waters *Heteranthera reniformis, Eriocaulon septangulare, Isnardia palustris* and *Utricularia gibba* form the first zone of plants outside the emersed aquatics.

There is no part of the Eastern Shore in which there is a larger number of constantly flowing streams of small size than in Dorchester County, where the various feeders of the Blackwater, Transquaking and Chicacomico rivers possess a greater variety of aquatic vegetation than is found elsewhere. Various species of *Potamogeton* are the commonest and most conspicuous of these, including *Potamogeton natans, Potamogeton nuttallii, Potamogeton pulcher, Potamogeton lonchites,* and *Potamogeton diversifolius,* together with *Ceratophyllum demersum, Myriophyllum pinnatum* and *Utricularia gibba.* Quieter waters abound in *Castalia odorata, Brasenia purpurea* and *Limnanthemum aquaticum,* mingling oftentimes with such plants as *Nymphaea advena, Pontederia cordata, Peltandra virginica, Polygonum amphibium* and *Rumex verticillatus,* which border the marginal Stream Swamps. The only floating members of the aquatic flora, *Lemna minor* and *Spirodela polyrrhiza,* are abundant in the quiet margins of such streams, often accompanied by the Hepatic *Riccia fluitans.* In both quiet and swift-flowing waters *Callitriche heterophylla* is abundant, together with *Potamogeton diversifolius.* (See Plate VI, Fig. 1.)

The still waters of the artificial mill-ponds so abundant on the Eastern Shore are not essentially different in their aquatic flora from the streams just described. *Castalia, Brasenia,* and such species as *Utricularia vulgaris, Potamogeton nuttallii* and *Potamogeton natans, Naias flexilis* and *Myriophyllum humile* are wide-spread and abundant. By no means wide-spread and found only in standing water is the interesting *Utricularia inflata,* which is conspicuous on the surface of the water by reason of the five to eight radiating stems which are enlarged by spongy tissue in a manner which enables them to serve as organs of flotation.

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Dune and Strand Vegetation.

The fringing bar which forms the ocean front of Maryland is very narrow from the Delaware line southward to the head of the Chincoteague Bay, below which it widens, but nowhere exceeds a mile in width. The bar is fringed by Fresh or Salt Marsh along its inner side and the outer side is a low series of Dunes, nowhere reaching such size as those at Cape Henry or Cape Henlopen and everywhere being in a comparatively stable condition (See Plate VIII, Fig. 2.) The only trees on the bar are those forming a small grove of Loblolly Pine at the extreme northern end near Fenwick Island Light.

The predominant plant of the Dunes is *Ammophila arenaria,* with which are associated the plants characteristic of dunes throughout the North Atlantic coast, as *Cakile edentula, Hudsonia tomentosa, Ammodenia peploides, Oenothera humifusa, Xanthium canadense, Salsola kali, Euphorbia polygonifolia* and *Polygonum maritimum.*

At a few places on the shores of the Chesapeake the tidal currents have transported sand and silt along shore in such a manner as to build spits or cusps projecting from the old shore line. These newly-built spits, with coarse sandy soil and soil water which is, at some times at least, highly salt are closely similar in their vegetation to the fringing bar of the Atlantic coast. Two of these spits are worthy of detailed description, one at Castle Haven in Dorchester County, and a second at Lloyds Creek, near Betterton in Kent County, beyond the range of the halophytic flora. The former is young in terms of its vegetation; the second much older as evidenced by the forest covering of its inner end.

The spit at Castle Haven projects eastward from a headland which shows evidence of having been worn back several hundred feet in very recent time (Fig. 7). The inner portion of the spit (*I*) is underlaid by the remains of a marsh, which has little effect upon the present conditions for vegetation. The outer portion (*II*) is recent. The old substratum is probably responsible for the small lake in the old part of the spit.

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FIG. 1.—VIEW SHOWING SCRUB PINE SEEDING AN ABANDONED FIELD, CALVERT COUNTY.

FIG. 2.—VIEW SHOWING LOBLOLLY PINE ON THE BEACH, NEAR PINEY POINT, ST. MARY'S COUNTY.

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Area I. has a shelving beach devoid of vegetation and bounded by a low bluff 1 to 2½ feet high. Its central portion is occupied by a sparse stand of *Ammophila arenaria,* with scattered individuals of *Cyperus grayi, Xanthium canadense, Cakile edentula, Euphorbia polygonifolia, Strophostyles helvola* and *Asparagus officinalis.* There are a few clumps of *Iva frutescens* and two individuals of the Red Cedar. The inner edge of the spit is also marked by a low bluff outside which is a fringe of *Spartina stricta* var. *maritima.* Surrounding the lake is a fringe of the same grass with a few individuals of *Baccharis* and *Iva.* Area III. is occupied by a marsh of *Spartina patens, Scirpus americanus, Solidago sempervirens* and *Juncus canadensis.* The inner edge of the marsh is also fringed by a scattered row of *Iva* and *Baccharis.* Area II. is devoid of vegetation and is covered by high tide.

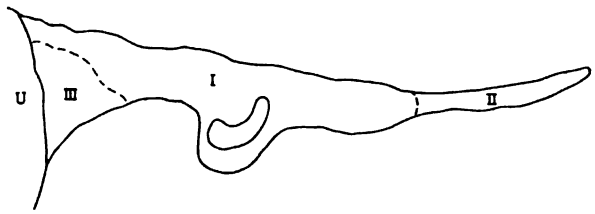

FIG. 7.—Diagram of the Plant growth on Castle Haven spit, Dorchester County.

Lloyds Creek is an irregularly triangular estuary, tributary to the Sassafras River. The spit extends from the western edge of the Creek toward the east, parallel to the general course of the shore line of the river. There is an island of old upland in the centre of the spit which was doubtless connected with the mainland by a tying-bar at a period much in advance of the formation of the outer end of the spit.

The outer beach of the spit is bounded by a low bluff, just within which there is a ridge from which the surface slopes away at first abruptly and then gradually to the water level on the inner side. The vegetation of the beach consisted, when visited, solely of scattered individuals of *Polonisia graveolens,* which is found in similar habitats at the north (and is here south of its reported range) and

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a few clumps of *Dianthera americana,* which has not been seen elsewhere in the Coastal Zone, being commoner in the shallow beds of running streams in the Midland and Mountain Zones. Area III. is level, without trees or shrubs and covered by a very open stand of the following:

Panicum virgatum
Andropogon virginicus
Diodia teres
Cyperus grayi
Physalis heterophylla
Apocynum cannabinum
Plantago lanceolata
Asparagus officinalis
Leptilon canadense
Strophostyles helvola
Poa compressa
Solidago sempervirens.

Area I. bears a very scattered stand of Red Cedar much overgrown with *Vitis labrusca,* a few trees of the Persimmon and a few young individuals of the Tree-of-Heaven and the Yellow Locust. In Area II., particularly that part of it in front of the island, there

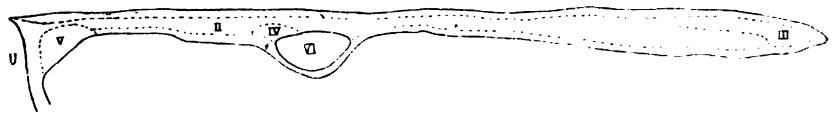

FIG. 8.—Diagram of the Plant growth on Lloyds Creek spit, Kent County.

is a closed stand of Red Cedar, Spanish Oak (one individual of which was 14 inches in diameter), Post Oak, Persimmon and Hackberry. Among the trees are numerous individuals of *Myrica carolinensis* and a few plants of *Euphorbia ipecacuanhae* and *Opuntia opuntia.* Area IV. is a small marsh bordered with *Baccharis* and with a mixed stand of *Hibiscus moscheutos, Peltandra virginica, Scirpus americanus, Scirpus robustus* and *Pontederia cordata.* Area V. is occupied by a marsh with *Typha* and *Acorus,* such as extends round the shores of the entire creek.

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Conclusions.

A review of the character of the dominant upland vegetation on the Eastern Shore shows that of the Talbot Formation to be related to that found in the tide-water sections of Virginia and North Carolina, and to the coniferous forest region of the southern Coastal Plain, while the vegetation of the Wicomico Formation is related to that of the Piedmont plateau of Maryland and the adjoining states. The botanical history of the Eastern Shore is that of the repeopling with plant life of an area which has been raised by two well-defined uplifts from the floor of the sea in recent geological time. The immigrant species which have reached the area through natural means have come partly from the older portions of the Coastal Plain in states to the south, and partly from the Piedmont Plateau of the contiguous land to the north. On the Wicomico Formation the Piedmont element predominates, on the Talbot Formation the southern or Coastal Plain element, which is to be attributed mainly to the persistence of the immigrant species on the soils most closely resembling those of their original habitat.

The distinctness of the vegetation of the Eastern Shore and of the Coastal Plain of New Jersey is most striking both from a floristic and from an ecological point of view. The Pine Barrens of New Jersey are an almost pure stand of *Pinus rigida,* a tree which is extremely rare on the Eastern Shore, and among their herbaceous plants are the Pine Barren species mentioned in Part II., which are of southern relationship, and a number of bog species, which are of northern relationship but are found much farther south both in and out of the mountains. On the Eastern Shore there are habitats which would appear to be congenial ones for the Pine Barren species, yet they are represented by a very few forms and the bog species are likewise absent. There is a notable difference in the topography and the local distribution of habitats in the two states, yet there are areas of Upland and of Upland Swamp in Maryland which appear to present conditions identical with those in certain habitats of the New Jersey Barrens. Botanical history likewise fails to afford an explanation of the observed facts, for the geomorphic histories of the Coastal Plain in Maryland and New Jersey have been identical.

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The natural secular changes in the character of the vegetation which are going on today are (1) those taking place on the Upland on account of changes in physical conditions due to erosion, (2) those taking place along the shore-lines and due to the formation or exposure of new plant habitats. In the preceding pages of this Chapter attention has been called to the Midland relationship of the forest found in the Flood Plains of the Eastern Shore and in Chapter II. several habitats were pointed out in which Midland species were found, otherwise rare in the Coastal Zone. The changes going on at present in the topography of the Upland of the Eastern Shore are very slight, on account of the small drainage area of the streams and the fact that the surface is already so nearly level. On the Wicomico terrace the Ravine Slopes are being worn back and the Flood Plains are gradually being built up. The conditions at the heads of some of the older Flood Plains would indicate that the Upland type of forest encroaches upon that of the Flood Plains as the latter silt up to a level at which their soil moisture content becomes equal to that of the Upland. Although the forests of the Flood Plains approach more nearly the mesophytic forests of the Piedmont yet they cannot be looked upon as the type which is the climax on the Eastern Shore. The Flood Plain forest is a transient one, representing the transition from Stream Swamp to Upland, and although it may be considered a higher type of forest than that of the Upland from a purely abstract point of view, yet it does not represent the natural balance between the flora of the Eastern Shore and the conditions which are most widespread and are determined by the maturing of the topography,—namely those of the Upland. Into the composition of the Upland forest come both the pines and the deciduous species,—Oaks, Gums and Maple, and all old stands of forest examined, and all evidence from the phenomena of reforestation would indicate that the climax forest of the Talbot Formation of the Eastern Shore is one in which the Pines are predominant but invariably accompanied by deciduous species. The Loblolly Pine is not infrequent in Swamps but is most abundant on light sands and on the Elkton Clay. While these soils may seem to be very dissimilar in their relation to the movement of soil water, yet the fineness of the clay causes it to hold to its stores

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of water so tenaciously that the plants growing in it often suffer drought when there is an abundance of water within very short distance but very firmly held by the capillarity of the fine soil. The Loblolly is, in other words found most abundantly in the soils which are subject to the greatest fluctuations of soil moisture content.

The feature of change in shore line topography which has the greatest mass effect upon vegetation is that of the filling in of coves and bays and the narrowing of estuaries. The deposition of silt in the marshes has increased greatly since the cultivation of the Upland incident to the settling of the country, and has tended to obscure the real trend of change. The upbuilding of Marshes invariably leads to the entrance of the Stream Swamp flora, some of the herbaceous members of which are already present in the Marshes. *Acer rubrum* is the first of the trees to enter the Marsh formation, as it does repeatedly for many years before the conditions are favorable for the development of the trees beyond the seedling stage. The upbuilding of shoals gives opportunity for the encroachment of the Marsh vegetation on the waters, which is taking place to a limited extent. The foremost plant in this advance is *Spartina stricta* var. *maritima*. Where the upbuilding is rapid and due to the action of currents rather than to the slow deposition of mud from muddy water, the soil is coarser and is raised to a level such that it is well drained. This process gives rise to sand bars or spits which maintain a xerophilous vegetation and develop a forest covering much more directly and rapidly than do the newly upbuilt Marshes, as has been described for several localities in Chesapeake Bay.

Geological evidence shows that the Eastern Shore is at present undergoing a slow subsidence, the end effect of which will be to offset the upbuilding of marshes, if not to actually increase the areas of marshland, causing them to encroach on the Upland. At two localities on the inner edge of the extensive marshes of Dorchester County the writer saw unmistakable evidence of the encroachment of the Fresh Marsh upon forests of *Pinus taeda*. These localities are where the Upland behind them is very flat for many miles. The slight erosion from this very stretch of country is

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attested by the brown color of the water of the streams (the Chicacomico, Transquaking and Little Blackwater Rivers) which are scarcely clouded even at times of heavy rain. Moreover the areas noted are miles from the outlets of the streams, and several miles from the open tidewater, so that they are doubly protected from the deposition of silt. The evidences of the encroachment of the Marsh are the occurrence of remains of *Pinus taeda* at considerable distance beyond the present forest and the occurrence of half dead trees well outside the line of the present shore. The Marsh plants, on the other hand, are to be found in the outermost zone of the Pine forest in undiminished abundance and vigor. The evidence of the vegetation was confirmed by learning at one of the localities that a plantation (Guinea Neck) had existed before the war in a place where there is now only a very small island not already occupied by Marsh vegetation.

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THE ECOLOGICAL PLANT GEOGRAPHY OF MARYLAND; COASTAL ZONE; WESTERN SHORE DISTRICT

BY

M. A. CHRYSLER

Introductory.

The Western Shore District is a favorable region for study since topographic maps of the whole area are obtainable, and four out of the six counties have been mapped by the United States Soil Survey in cooperation with the Maryland Geological Survey. The climatic conditions have also been carefully studied. Since Baltimore lies in the district, and Washington lies on its border, lists and collections of plants have been easily available. It was found possible to visit a few of the localities twice, in June and September, but most of the work was done during July and August, hence no mention is made of vernal vegetation. This is the less unfortunate in that the arborescent vegetation seems to be the most important from the ecological standpoint, and in that the salt marshes show their most characteristic vegetation in the latter part of the season.

Topography and Soils.

This district of the Coastal Zone lies, as its name implies, on the western shore of Chesapeake Bay. It extends from about latitude 38°N to 39° 30′N., a distance of almost 100 miles, and has a maximum width of 40 miles in the southern part, where it includes practically all of the counties of Charles, St. Mary's, Calvert, Anne Arundel, and most of Prince George's, while at its northern extremity it narrows rapidly, including a strip along the eastern side of Baltimore and Harford counties. It has approximately the form

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of a right-angled triangle with the apex in western Charles County and the hypotenuse along Chesapeake Bay. Along its western side, where it does not border on the Potomac River it merges into the Piedmont Plateau, or Midland Zone. The total area is about 2100 square miles. Except along the shore of Calvert County, the coast is much indented by estuaries. As to relief the surface may be roughly divided into (1) a bordering fringe of low flat country having a greater or less breadth and occupying the bulk of the peninsulas such as Gunpowder Neck, and (2) an inner plateau ranging in height from 120 to 250 feet or more, where it joins the Midland Zone. The second section is usually gently undulating, but in some places the divides are scored by deep ravines, as in the vicinity of Marlborough, Prince George's County. On the east side of Calvert County the marginal strip is lacking, and the shore is precipitous owing to the erosion along the western side of Chesapeake Bay. In most instances a narrow strip of sandy beach lines the cliff, but on headlands the sediment has been swept away by littoral currents. For a more detailed account of the topography of the region the reader is referred to Vol. I. of the Publications of the Maryland Weather Service.

Owing to the labors of the Soil Survey, the soils of the region are well understood, the following counties having been surveyed: St. Mary's, Calvert, Prince George's and Harford. The results so obtained have been used as a basis for many of the observations made in the present chapter. Throughout the Coastal Plain only sedimentary deposits occur, consisting of unconsolidated sands, clays and gravels, together with remains of organic life such as marl beds. In most parts of the area the bed-rock lies too far below the surface to exert any influence on vegetation. The soils represent deposits of material of a variety of kinds brought by streams and littoral currents during one or another of the periods of submergence of the region. These deposits have been repeatedly elevated and subjected to the action of atmospheric agents and running water, so that the materials have undergone some rearrangement even since the last elevation of the strata. The effect of this series of events has been to mix the deposits which may earlier have been

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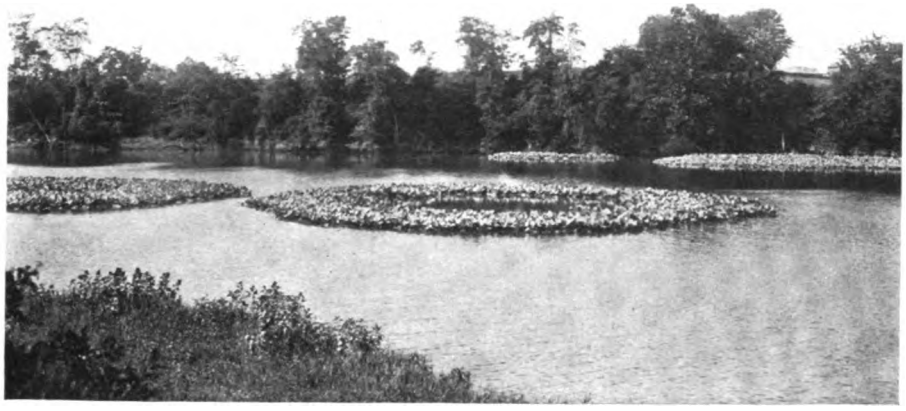

FIG. 1.—VIEW SHOWING "ATOLL" APPEARANCE OF COMMUNITIES OF YELLOW WATER LILY, NEAR UPPER MARLBORO, PRINCE GEORGE'S COUNTY.

FIG. 2.—VIEW SHOWING A FIELD OF TOBACCO IN CHARLES COUNTY.

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separate, so that a considerable variety of soils are found in the district, including clays, loams, sands, of which the following deserve notice:

Susquehanna clay. A stiff purplish colored impervious soil, familiar to those who have traveled by train between Washington and Baltimore.

Elkton clay. A yellow-gray variety, becoming friable when drained. Found at the heads of embayments in Harford County.

Leonardtown loam. A silty yellow loam, clay-like when wet, and forming hard lumps when dried. It occurs in extended areas in St. Mary's County, where it is sometimes called "white oak soil."

Norfolk loam. More sandy than the preceding, and more valuable for agricultural purposes. Not so widely distributed as the preceding, but found in St. Mary's County and the "Forest of Prince George" in south-east Prince George's County.

Collington sandy loam. A residual soil derived from the weathering of greensand; has a loose loamy, coarse texture. One of the richest soils of the region. A large area occurs in the "Forest of Prince George."

Sassafras loam. A mixture of sand and clay derived from older strata and redeposited by stream action. In the southern part of the area it occupies a level 60 to 90 feet above tide-water, but in Harford and Baltimore counties, occupies the region which borders on the Bay, and is often low and swampy.

Norfolk sand. A reddish loamy material found in high and also in low positions, owing to stream action. Widely distributed in Calvert County.

Windsor sand. Coarser than the last, with an even coarser subsoil. Found in northern St. Mary's and Calvert counties.

Meadow. Under this name are included the areas along the bottoms of streams, also more particularly the low flat areas bordering many of the larger bodies of water, and composed of fine silt and clay deposited while the area was submerged.

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Vegetation.

Two topics of paramount interest present themselves in this region: The succession of types of forest growth and the salt marshes with their transition to fresh marshes. Seldom does a better opportunity arise for observing the succession of groups of arborescent growth which may cover an area. In southern Maryland many areas which were highly cultivated prior to 1865 have for forty years been neglected by man so that nature has been able to work out her own methods which are of much interest. Moreover the large number of estuaries and bays makes possible a thorough study of the relation between halophytic and fresh water vegetation. Other topics are dealt with, as may be seen from a glance at the table of contents. The forests will be first considered.

Forests.

Considering the proximity of the region to the nation's capital, a surprisingly large portion of the surface is forest-covered. In St. Mary's County fully half the area is uncultivated, for economic reasons which do not need to be discussed here. It was hoped that some areas of virgin forest might be found, hence inquiries and search were made in many places. The nearest approach to original conditions was seen on Lord Calvert's estate in Prince George's County, on a tract two miles north of Harwood in Anne Arundel County, at Leonardtown in St. Mary's County, and in the Zekiah swamp in Charles County, but on none of these tracts does an unaltered growth occur. They will be further considered in appropriate places. A fairly natural division of the forests into upland and lowland may be made.

Upland Forests.—An attempt is here made to arrange these into ecological groups which will represent the order of development of forests in accordance with the now well-accepted principle of succession, which may be stated thus: the vegetation found upon an area does not represent a fixed or stable condition, but one of progressive change, dependent upon the changing topography of the region and on changes in soil, etc., brought about by the plants them-

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selves. The problem as presented in Southern Maryland is, given an estate consisting of abandoned fields, what will be the history of such a tract if it is not interfered with? With this problem in view we may proceed to a description of the various types.

Pine Association.—The pines which are common in this district are two in number, the Scrub Pine (*Pinus virginiana*) and the Loblolly Pine (*Pinus taeda*). Regarding other species, the reports of the Soil Survey speak of "Pitch Pine" as occurring in St. Mary's County. This name is ordinarily applied to *Pinus rigida,* but in the reports mentioned, manifestly refers to *Pinus virginiana.* Mell* includes *Pinus rigida* in his catalogue of the trees occurring in St. Mary's County, although Curran† does not mention it as occurring in Calvert County, where the conditions ought to be quite as favorable for this species. Curran (l.c.) reports the occurrence of *Pinus echinata* in Calvert County to the extent of less than 5% in Scrub Pine associations. Strangely enough Mell does not include this species in his list of the trees of St. Mary's County although on account of the southerly range of the species one would expect to find it on the peninsula terminated by Point Lookout as well as in Calvert County. In St. Mary's County the writer was informed of the occurrence of a "Yellow Pine," but no person pointed out any examples to the writer, who also was unable to discover any. It was thought that in the northern part of the district, toward Havre de Grace, additional species might be found, but this area proved to have very few pines, and these of the two species common throughout the district. The Scrub Pine, commonly called "spruce pine" in the region, doubtless on account of the shortness of its leaves, is the most abundant conifer of the Western Shore District. It is easily distinguished by the shortness of its leaves and by their grouping in fascicles of two. As is true of pines in general, it has two forms, dependent upon whether the trees grow isolated or in close association. The two types are shown in Plates X and XI. The former shows the usual appearance of the tree as

*Mell, C. D. The Forests of St. Mary's County. Maryland Geological Survey, St. Mary's County, 1907.

†Curran, H. M. The Forests of Calvert County. Maryland Geological Survey, Calvert County, 1907.

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found on sandy beaches with its low, branching habit and the persistence of its cones. The latter represents part of an almost pure stand in St. Mary's County, from which much of the older timber has been cut, showing their habit of growth when crowded. This species is found in every part of the district and in all sorts of habitats, from a clay bluff to a mesophytic valley, though much less common in the latter location. It may occur to the exclusion of all other trees, as on small tracts in many places in Southern Maryland, for example, at Bel Alton in Charles County, and at Hill's Bridge, and South River, in Anne Arundel County. Usually, however, these pure stands are of young trees, representing in a number of cases, a field which had been abandoned for upwards of a score of years. That this species is the pioneer tree in such positions was abundantly proved by observation of all stages of its invasion of vacant areas. In some cases the furrows of the corn field were still distinct, yet the pines upon the area were 10 to 20 feet high. Several features of the Pine enable it to play the part of a pioneer. Its winged seeds cause it to spread more quickly than do trees whose seeds are heavy, as for example, the oaks. Further the pines of this region are able to endure strong insolation and dryness of soil, even in the young stages. Again, they are fast growers, so that they easily overtop other trees which may begin the race at the same time. The consideration of a specific case will be of advantage. On a plot 33 feet square in a corn field which has been left for three or four years were found the following: Scrub Pine, 2 seedlings, Loblolly Pine, 10 seedlings, (both of these derived from a grove near by), Hickory, 1 seedling, Black Gum, 1 seedling, Persimmon, 2 small saplings (which had doubtless been allowed to grow while the field was in use) and 3 seedlings, 13 plants of *Rubus villosus* and *Rubus canadensis,* together with herbaceous vegetation such as *Potentilla canadensis, Solidago* and *Erigeron* of several species. Judging by the appearance of neighboring areas, the pines would in a few years overtop the other trees present, and a pure pine stand would occupy the field.

Habitats where Scrub Pine seems likely to more or less permanently usurp the area are (1) hilltops, on account of dryness of the soil and strength of the wind, (2) sand strands, where the humus content of the soil is insufficient to support many species,

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and the salt winds too prevalent to admit of oaks. In accordance with its xerophytic habit, the Scrub Pine is generally the first tree to appear on the sides of railway cuttings, as may be seen, for example, near Rosedale in Baltimore County on the Baltimore and Ohio Railroad. No account of herbaceous vegetation need be given, for in a pure stand of pine the trees are so close together that there is insufficient light for any undergrowth, in fact the excessive crowding of the trees prevents their own proper development.

The other pine of the region, the Loblolly, can be readily distinguished by its longer leaves, which are grouped in threes. It commonly goes by the name of "Foxtail Pine." On the sand strand at Piney Point, St. Mary's County, the vegetation is almost entirely coniferous, including Scrub Pine and Red Cedar, as well as Loblolly Pine. The latter occurs in pure stands in southern St. Mary's County, for example, at St. Georges Island, and readily reseeds an area which has been cut over. In other localities it occurs mixed with the other species, and frequently it is found as scattered individuals, especially towards the northern part of the district. The relative abundance of the two species is about two of Scrub Pine to one of Loblolly, although this ratio does not hold for the extreme southern part of the district, which lies near the region where the latter is dominant. A careful investigation was made of its distribution. It is found in all except the extreme northern parts of the district,* and seems able to live in a great variety of habitats, being better fitted than the Scrub Pine to endure the effects of salt soil and atmosphere, and the strong winds which are met in positions bordering the larger rivers and estuaries. This is illustrated by the flora of St. Georges Island, already referred to. Here we find no Scrub Pine (although this species occurs on the adjacent mainland), but in places some Spanish Oak and Sweet Gum are present. Although it is relatively more abundant near the coast, the Loblolly is by no means lacking in the interior, for it occurs at the extreme inner limit of the district, as at College Park and Laurel, Prince George's County. Although it is able to endure maritime conditions, it is apparently not so xerophytic a species as the

*The northern limit of the species is stated by Sargent to be Cape May, New Jersey.

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Scrub Pine, as may be seen from a consideration of the following table:

TABLE OF COMPARATIVE FREQUENCY OF COMMON TREES.

	Upland Loam	Upland Sand	Upland Depressions	Meadow	Sassafras Loam	Notes
Pinus virginiana	88	100	27	86	64	Xerophytic; pioneer.
Pinus taeda	35	35	27	76	16	Marginal; southern.
Juniperus virginiana	58	26	20	71	24	Marginal and xerophytic.
Quercus alba	100	84	60	67	100	Ubiquitous.
Quercus prinus	8	22	20	14	52	
Quercus minor	52	51	7	43	32	Moderately xerophytic.
Quercus phellos	18	10	33	43	56	Prefers low ground.
Quercus velutina*	73	68	47	67	88	Ubiquitous.
Quercus palustris	9	3	40	24	68	Hydro-mesophytic.
Quercus marylandica	39	39	.....	10	....	Xerophytic.
Quercus digitata	68	61	13	81	68	Moderately xerophytic.
Castanea dentata	64	93	47	38	68	On drained soil; calciphobe.
Betula nigra	2	6	53	10	....	In swamps and low ground.
Fagus americana	21	22	33	29	40	Mesophytic.
Hicoria spp.	76	64	27	24	68	
Liquidambar styraciflua	64	42	100	100	92	Prefers moist situations.
Liriodendron tulipfera	45	58	80	29	48	On mesophytic slopes.
Acer rubrum	28	32	100	52	92	Mesophytic; moisture loving.
Nyssa sylvatica	26	19	53	67	88	Mesophytic; moisture loving.
Diospyros virginiana	38	22	20	57	16	
Platanus occidentalis	9	22	73	33	8	Mesophytic; river banks.
Ilex opaca	35	26	33	76	28	
Cornus florida	55	48	53	48	36	
Sassafras sassafras	47	55	27	62	52	

*Includes Quercus rubra.

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This table includes the trees occurring most frequently in the region, and represents the result of a large number of observations. The consideration of an example will make clear the method of estimation employed. In the column "Upland loam" it will be seen that the White Oak is marked 100; this means that it occurs in all (i.e. 100%) of the forest tracts situated on loam on the uplands of the district (as far as they were examined); Scrub Pine is marked 88, indicating that it was found in 88% of the tracts examined; similarly the Buttonwood was found in only 9% of the "Upland loam" forests which were visited. The table represents merely an approximation to the relative abundance of the various species, but even as such is highly instructive. For instance, it will be seen that while the Loblolly Pine occurs in 76% of the forests on "Meadow," it occurs on only 35% of the forests on "Upland sand," while for the Scrub Pine the numbers are respectively 86 and 100. It is fair to infer, therefore, as stated above, that the Loblolly Pine is the less xerophytic species, and will thrive under poorer drainage conditions.

Pine-Oak Association.—As was stated above, pines of an age of forty to fifty years are usually accompanied by oaks, in proportions varying greatly according to circumstances. The most common oak in the upland formations is undoubtedly the White Oak. Three other oaks are also widely distributed and numerous as to individuals, the Black Oak, the Spanish Oak, and the Post Oak. In the third rank is the Black Jack Oak, which is most abundant in the most xerophytic tracts of the area, such as the Susquehanna clay near Bowie, Prince George's County. Forests consisting largely of these oaks and one or both of the pines are to be found everywhere through the district, and are by far the commonest sort of forest. As will be subsequently discussed, the Pine-Oak association is believed to represent a sort of adolescent stage in the development of the forests, being preceded by the Pine association and followed by one in which pines are absent. The struggle for supremacy between the oaks and pines is apparent in many places. Other oaks than those mentioned may appear in this association, but they are characteristic rather of later stages of forest develop-

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ment. The same may be said of Sweet Gum, Black Gum, Chestnut and Hickory. Forming a second zone underneath the tall trees are often to be seen the Dogwood, the Holly, the Laurel, and in the more open spaces the Red Cedar, the Persimmon, the Sassafras and Sumac. A third zone is usually formed by ericaceous shrubs such as *Gaylussacia resinosa, Vaccinium sp., Pieris mariana, Azalea nudiflora.* The herbaceous vegetation is of a somewhat xerophytic type, and includes:

Lycopodium obscurum
Lycopodium complanatum
Pteris aquilina
Dryopteris achrostichoides
Cypripedium acaule
Peramium pubescens
Hypoxis hirsuta
Sarothra gentianoides
Baptisia tinctoria
Cracca virginiana
Meibomia sp.
Epigaea repens
Chimaphila maculata
Chimaphila umbellata
Mitchella repens
Gerardia purpurea
Melampyrum lineare
Cunila originoides
Sericocarpus asteroides
Chrysopsis mariana
Aster ericoides
Coreopsis verticillata.

Oak-Hickory Association.—Forests in which oaks and hickories predominate occur in the more mesophytic areas of the uplands, especially on the soil known as Collington sandy loam, in the "Forest of Prince George." Pines, oaks and hickories sometimes all occur together, but this seems to represent a temporary condition, for

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FIG. 1.—VIEW SHOWING REPRODUCTION OF LOBLOLLY PINE, ST. MARY'S COUNTY.

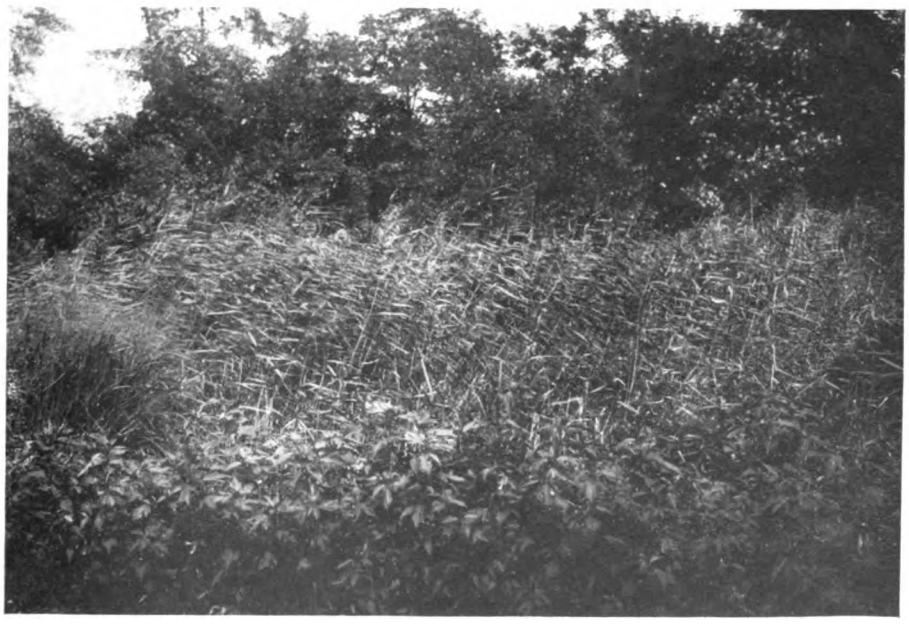

FIG. 2.—VIEW SHOWING REEDS AND RAGWEED ON THE BEACH, CURTIS BAY, ANNE ARUNDEL COUNTY.

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in the dense shade produced by the hardwoods the pines do not thrive. The xerophytic oaks such as the Black Jack, Spanish Oak and Post Oak, are largely replaced by White Oak and Black Oak, which here take the lead, accompanied by some Red Oak and several species of Hickory (*Hicoria ovata, Hicoria alba* and *Hicoria glabra*). The Tulip-tree is a frequent member of this association, especially on the sloping sides of depressions, where also thrives the Beech. Less important constituents are the Persimmon, the Yellow Locust and the Sweet Gum. While species of oak and hickory and the Tulip-tree frequently form the bulk of a forest, another constituent may form so large a proportion that it almost gives rise to what might be called a distinct association; this is the Chestnut. It prefers well-drained sandy slopes, where it commonly replaces the Tulip-tree of moister slopes. On account of the demand for its timber it is frequently seen as coppice. As an example of a rather xerophytic type of such a forest, the following enumeration is given, referring to a ten-acre tract at Leonardtown, St. Mary's County. The tract bore some evidence of being a part of the original growth, for the trees were of great age; on the stump of an oak recently felled were counted 106 rings. The soil was Leonardtown loam, and the general level of the tract was about 80 feet above tide water. The plants seen with their relative abundance was as follows:

Quercus minor	47%
Quercus digitata	21%
Quercus velutina	9%
Quercus alba	7%
Castanea dentata	6%
Hicoria sp.	3%
Other trees	7%

In more mesophytic woods a smaller proportion of the first two oaks and a larger proportion of hickory is the rule. Underneath the oaks, etc., a second zone is usually present, which in the higher areas consists of Dogwood, sometimes as rather large trees, Red Cedar, Sassafras, Holly, Laurel and Sumac (*Rhus copallina, Rhus hirta, Rhus glabra*). The humus content of the soil in these woods

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is generally high, so that the most mesophytic forms of herbaceous vegetation are found.

Maple-Gum Association.—This title is meant to include the highly mesophytic assemblage found in depressions or valleys of the uplands. A glance at Table 1 will show that in such places neither oaks nor hickories prevail but that their dominant place is taken by the Sweet Gum and the Red Maple, with the Tulip-Tree as the next most important constituent. Equally characteristic though not present in such large numbers are the Beech, the Swamp Oak, the Black Gum and the Buttonwood and in the moister places, the River Birch and the Sweet Birch. The White Oak and Black Oak by no means disappear, and the Willow Oak is found in many cases. The Tulip-Tree, the Beech and the oaks are the trees on the tension line between the depressions and the higher parts of the area; Sweet Gum also occurs on fairly high ground, but not in large numbers, while Maple, Buttonwood and Birch fail to spread upward along the slopes to any extent. Certain other trees of a highly mesophytic type find the necessary moisture and shelter in such places; e. g., the Red Mulberry, the Elm, the Black Walnut, and the White Ash. The lower zone of this association is quite typical, including:

Cornus florida
Sassafras sassafras
Ilex opaca
Aralia spinosa
Asimina triloba
Magnolia virginiana
Cercis canadensis
Carpinus caroliniana
Alnus rugosa
Sambucus canadensis
Pieris mariana
Clethra alnifolia
Corylus americana
Benzoin benzoin.

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The herbaceous vegetation includes a large number of shade and moisture-loving species.

Lowland Forests.—This division includes the growth on the low-lying tracts bordering the larger bodies of water, also the flood plains of streams. It does not present the same variety as the first division, for the conditions are not so diversified. At the same time the vegetation is more luxuriant, on account of the better supply of moisture. Two associations may be distinguished.

Gum-Pine Association.—On the soil areas marked "Meadow" on the soil maps, namely the low flat areas bordering on the larger bodies of water, is found a characteristic assemblage of trees. The areas are poorly drained, and as was stated in the section on soils, the material is a fine gray silty loam. An extended area of this kind occurs in the peninsula between the Potomac and Wicomico rivers in southern Charles County, also at the south-east extremity of St. Mary's County. On these areas the dominant tree is the Sweet Gum which occurs in all sizes and overruns the roadsides like a weed. A glance at Table 1 will show that it is in this association that the Loblolly Pine reaches its maximum development. In some places in fact it is the dominant tree, as was mentioned when considering the Pine Association, but generally it is outnumbered by the hardwoods. The Scrub Pine is frequently found mixed with the Loblolly and the hardwoods and there is the same struggle for supremacy between hardwoods and conifers as was seen on the uplands. One other conifer, the Red Cedar, is especially common in the regions near the water. A highly characteristic tree is the Willow Oak, which though often outnumbered by White Oak and Black Oak, reaches its best development here. Other trees of conspicuous occurrence are the Spanish Oak, Black Gum, the Persimmon and the Maple. Quite as conspicuous,—by their rarity,—are the Tulip-Tree, the Hickories and the Chestnut. This may be accounted for by the poor drainage of such areas and by a possible chemical factor; the chestnut having long had a reputation for avoiding calcareous soils, which would account for its greater abundance on sandy hillsides. Characteristic members of a lower zone are: the Holly, which is especially abundant in this association, the Sassafras, Dogwood, Sumac and Sweet Pepper-bush.

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Oak-Gum Association.—On the necks of land stretching southeast from Baltimore and Harford counties occur tree assemblages to which the above name is given. These "necks" resemble in a general way the peninsulas stretching in a similar direction from Charles and St. Mary's counties, but the difference in vegetation of the two regions seems sufficiently striking to necessitate separating them. To begin with, this association shows a greater number of oaks than does any other. White Oak is dominant though Sweet Gum is almost equally abundant, while Chestnut Oak, Willow Oak, Black Oak and Swamp Oak are more numerous here than they are in any other situation. In marked distinction to the "Meadow," Chestnut is frequent, even on low ground, while Hickories, Maple and Black Gum also occur plentifully. On the other hand there is but little Pine, Cedar or Holly. An examination of the soil map shows that the areas in question do not consist of Meadow, but of Sassafras loam, and the mechanical analysis of the two differ to a certain extent, as the following comparison shows:

MECHANICAL ANALYSIS.*

	Organic Matter	Gravel	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt	Clay
		2-1m/m	1-0.5m/m	0.5-0.25m/m	0.25-0.1m/m	0.1-0.05m/m	0.05-0.005m/m	0.005-0.0001m/m
Meadow, St. Mary's Co.	1.84%	Tr.	0.88%	0.83%	3.76%	23.35%	59.59%	9.58%
Sassafras loam, Harford Co..	4.88%	0.52%	4.46%	6.28%	5.72%	6.08%	59.80%	12.54%

*From Reports of U. S. Bureau of Soils for 1900 and 1901.

The most noticeable difference in the two soils is the relative amounts of medium and coarse sand. The greater proportion of these in the Sassafras loam ensures better drainage, which may account for the greater abundance of Chestnut, Hickory and Tulip-Tree.

River Swamps.—These correspond in general to the flood plain of the rivers, and accordingly have a soil derived from the periodic deposit of sediment by the river. They vary greatly as to water content, not only among each other but in the same swamp at different times of year, and in different parts of the swamp, hence con-

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siderable variety is seen in their vegetation. The most extensive tract which was visited is the celebrated Zekiah swamp in Charles County, which occupies the valley of the Wicomico River for a distance of fully ten miles, and has a width of one-half to one mile. At its southern end it merges into a fresh marsh, as may be seen at Allen Fresh. At some seasons of the year the swamp is largely flooded, but at the time visited (July 1st and 10th) it might be considered a low-lying forest traversed by several branches of the River. Owing to its frequent inundation the soil is a soft rich alluvial material, and the arborescent covering is so dense that not only is the soil constantly moist, but herbaceous vegetation is sparse. On the fallen trunks grow a great variety of mosses and slime-moulds, as well as fleshy fungi. The composition of the forest varies somewhat in different parts, probably owing to relative moisture. In one section, near the junction of Clark Run, with the main stream, where the level is only moderately low (in fact part has at one time been under cultivation), the dominant tree is Sweet Gum, associated with much Black Gum, Red Maple, Willow Oak, Swamp Oak, Beech, Holly, and other species in smaller numbers. Half a mile farther north the leading species is the River Birch, while Sweet Gum, Willow Oak, the Hornbeam, and Holly take second rank. A more extended examination was made of the region at the point where the county bridge crosses the swamp. Here the general level is low, with standing water in many places. Many large trees are to be seen here, left, no doubt, because of the great difficulty in getting out timber. These are generally Swamp Oak, although other species are common as e. g., Hornbeam, Sweet Gum, Maple, Birch, Black Gum and Holly; while Ash, Elm, Willow Oak, Black Oak, Overcup Oak and Paw Paw are less common. Along the water courses Alders, Willows, the Button Bush and the Winterberry are frequent, and on the road are specimens of Buttonwood, a tree which is uncommon in the body of the swamp.

Besides the Zekiah swamp there are others of smaller area in the district, as along the Patuxent between Anne Arundel and Prince George's counties. Here, as in the previous case, the dominant trees are Sweet Gum, River Birch and Swamp Oak, but here, the Buttonwood becomes more plentiful, and the Box-elder is a con-

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spicuous element. The shrubs common in this association are *Vaccinium corymbosum, Sambucus canadensis, Clethra alnifolia* and *Pieris mariana.* The woody vegetation of the wetter places is mostly shrubby, including *Alnus rugosa, Salix nigra, Cephalanthus occidentalis, Vaccinium corymbosum, Rosa carolina, Ilex verticillata.* A striking feature of such associations is the large number and luxuriance of the climbers.* These include various species of *Smilax* and *Vitis, Rhus radicans, Parthenocissus quinquefolia,* etc. In some places the tangle formed by *Smilax* is almost impenetrable, while the other climbers ascend far into the crown of the trees. The herbaceous vegetation, includes the following:

Onoclea sensibilis
Alisma plantago-aquatica
Arisaema triphyllum
Peltandra virginica
Saururus cernuus
Asclepias incarnata
Penthorum sedoides
Polygonum arifolium
Triadenum virginicum.

While in the drier parts is found a typical flood-plain flora including, during July and August:

Woodwardia areolata
Botrychium ternatum
Boehmeria cylindrica

*Following the classification of Schenk (Beiträge zur Biologie und Anatomie der Lianen) these may be arranged thus:

1. Clambering by hooked prickles—*Polygonum arifolium, Polygonum sagittatum, Galium.*
2. Climbing by aerial roots—*Rhus radicans, Tecoma radicans.*
3. Twining—*Dioscorea villosa, Menispermum canadense, Celastrus scandens, Clitoria mariana, Galactia volubilis, Falcata comosa, Apios apios. Strophostyles helvola, Strophostyles umbellata, Vincetoxicum carolinensis. Lonicera japonica, Willughbaeya scandens, Convolvulus sepium, Convolvulus arvensis, Ipomoea purpurea, Ipomoea hederacea.*
4. Climbing by tendrils, consisting of
   (a) Modified leaves: *Smilax rotundifolia, Vicia sativa.*
   (b) Modified shoots: *Vitis sp. Parthenocissus quinquefolia, Micrampelis lobata.*

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Adicea pumila
Polygonum virginianum
Thalictrum polygamum
Impatiens biflora
Rhexia mariana
Hypericum maculatum
Sanicula marylandica
Cicuta maculata
Deringa canadensis
Steironema ciliatum
Phlox paniculata
Sabbatia angularis
Lycopus virginicus
Teucrium canadense
Verbena hastata
Asclepias incarnata
Cuscuta gronovii
Mimulus ringens
Lobelia cardinalis
Heliopsis helianthoides
Rudbeckia laciniata
Eupatorium perfoliatum
Eupatorium purpureum
Lactuca villosa.

No doubt this list would have been more satisfactory if collections could have been made earlier in the season, for the vernal plants of flood plains are very characteristic.

Cypress swamps.—The northern limit of The Bald Cypress (*Taxodium distichum*) is stated by Sargent to be southern Delaware, so that Southern Maryland is just within the range of this species. Only two examples of these swamps are known to the writer, one in Wicomico County on the Eastern Shore, and the other in Calvert County in the valley of Battle Creek. Only the outskirts of the latter swamp were visited, but Curran (l.c.) records the occurrence of trees having a diameter of 60 inches, though

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the average is 10 inches, indicating that most of the timber is second growth. The characteristic "knees"* of the cypress are fairly displayed in this swamp, although one misses the hanging bunches of Spanish moss, *Tillandsia,* which help to give the weird effect to typical examples of these swamps in the southern states. Other trees, especially Black Gum, usually accompany the Cypress but are present in small proportion. Very little undergrowth occurs, owing partly to the dense shade and partly to the inundated condition of such swamps.

Succession.—The general principle of succession has already been stated. It is desirable to consider at this point whether the associations already described conform to the principle. Beginning with the pine association, it was found by inquiry that certain tracts now covered with pine (or pines with a sprinkling of oaks) were in a high state of cultivation forty years ago, but that after the Civil War were neglected on account of the difficulty of securing labor. There is abundant reason for believing that in such areas Scrub Pine is the pioneer invader, and the features of this tree which fit it for such a role have been pointed out. But in spite of its hardiness the Scrub Pine is a short-lived tree, so that sooner or later openings appear in the originally pure stand. Besides old age, the woodman's axe, lightning strokes and severe storms aid in making gaps. Meanwhile seeds of hardwoods have been dropped among the pines by the agency of wind, birds and squirrels, the mode varying with the seed in question. Although oaks have a seed which is apparently not easily distributed, the trees generally occur in such numbers that a large number of acorns are produced. Moreover oaks as a rule will grow in a soil not well supplied with humus. Hence in the openings in the pine woods oak seedlings spring up, and owing to their having greater tolerance than have pines, are able to grow, even though slowly, in such a position, while the pines on account of their intolerance are unable under such conditions to reseed the spaces left by a tree falling. As these openings

*See Kearney, T. H. Report on a Botanical Survey of the Dismal Swamp Region. Contrib. U. S. Nat. Herb., vol. v, 1901. Also Coulter, S. M., An ecological comparison of some typical swamp areas. Rep. Missouri Bot. Garden, vol. xv, 1904.

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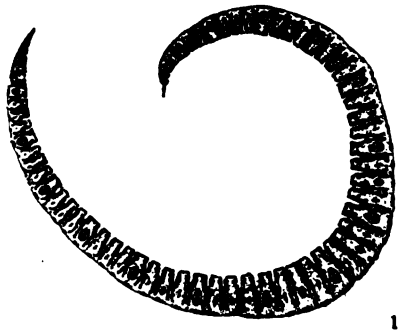

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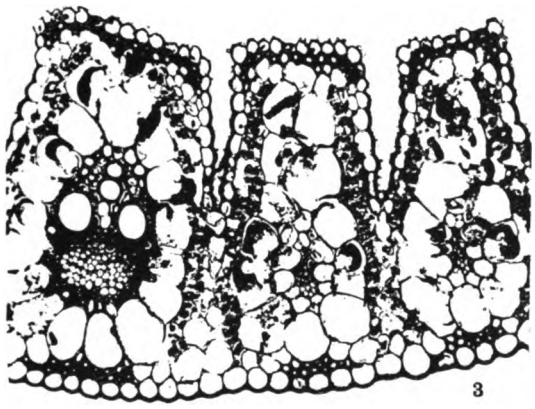

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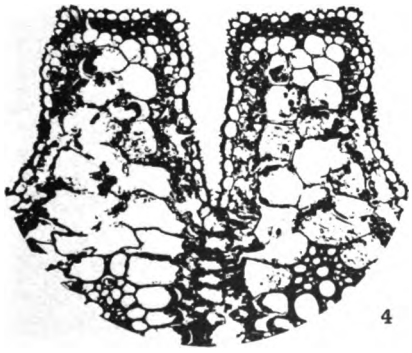

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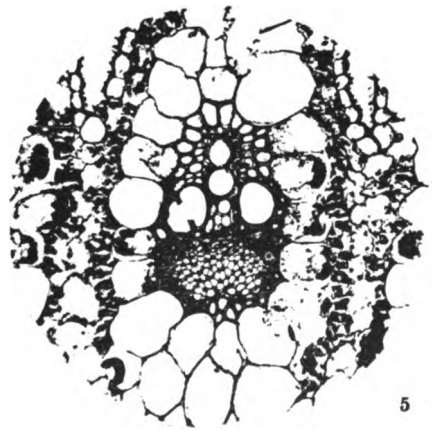

5

VIEWS SHOWING THE LEAF ANATOMY OF SPARTINA STRICTA var MARITIMA.

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enlarge and become more numerous, the young or dwarfed oaks which have been biding their time now begin more rapid growth, so that before many years there is a mixed pine and oak growth.

As the humus content of the soil increases, the existence of certain other species is made possible, for example, hickories find a suitable habitat, and less xerophytic species of oak are able to grow, hence we find many forests in the oak-hickory stage.

In the account of the Upland Forests a fourth association, namely the Maple-Gum, was described. Since a Maple-Beech association is known to succeed the Oak-Hickory in regions further north (*vide infra*), observations were made on the origin of the Maple-Gum formation. Although the Red Maple occurs to a certain extent in the border region between the uplands proper and the depressions in which is found the assemblage named "Maple-Gum association," the latter essentially belongs to the valleys, where according to the writer's observations it immediately succeeds the pines as do the oaks in higher situations. A good illustration of this occurs near Bowie, Prince George's County. On this piece of rather low ground the pines have begun to die out, and there is a plentiful undergrowth of maple and sweet gum. Owing to the great degree of tolerance possessed by the Red Maple, it is entirely probable that the seedlings will live until further breaks occur in the pines, when a forest of maple and gum will spring up. Owing to the exceedingly mesophytic conditions in the places where they occur, other trees such as the Buttonwood, Tulip-tree, Beech and Black Gum find the necessary shelter, so that this association comes to include a greater variety of trees than any other.

The succession of the lowlands, on the other hand, seems to be from pine to a mixture of gum and oaks, with Sweet Gum as the pioneer. After this tree has crowded out most of the pines with the aid of such xerophytic oaks as the Spanish Oak, the more mesophytic oaks such as the White, Black, Willow and Swamp Oaks, together with Maple and Black Gum, make their appearance. Hence the series has probably been: pine, pine-gum, gum-oak. Most of the coastal forests show a large admixture of pine, but it has been pointed out that on the Sassafras loam there are but few pines, with large numbers of various species of oaks, and even hickories

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and Chestnut. It is probable that the latter areas are slightly older geologically than the "meadow," and they appear to have progressed a step in the evolution of a lowland forest.

The succession as just detailed proceeds upon the assumption that the area was clear at the beginning, and that adult pines were present in the neighborhood to furnish seed. Neither of these assumptions is necessarily true for a given area, though in most cases they are true. If a tract does not enter upon these chapters of its history in the condition of an abandoned field but as a partially cleared wood-lot, the point at which the succession begins will of course vary according to the kinds of trees which were present on the tract when the cutting was done. In this connection one frequently hears the saying "If you cut off the pines, oaks make their appearance, and if you cut off oaks, pines spring up." If this statement were taken to indicate that the succession might take place in either direction, it would be incorrect, but it states a partial truth. It has already been shown that pines are in an untouched tract replaced by oaks in the course of time; this change may be hastened by the agency of man, for in a pine forest old enough to be cut for timber there is sure to be an undergrowth of oak which is then given a chance to develop. Hence the first part of the statement is readily explained. The second part, to the effect that pines succeed oaks, seems to be true only in case the whole of a forest cover is removed, and in such a way as to seriously damage the seedlings and saplings of oak, hickory, etc., and thus admit enough light for the growth of the pine seedlings, which soon overtop the oak seedlings on account of the rapid growth of the former, and thus achieve a temporary victory. If many seedlings of oak are left by the woodman, competition ensues between the oaks and pines. If selective cutting has been practised, the oak and hickory seedlings at once shoot up, and pine seedlings do not obtain the necessary light, for they are extremely intolerant. Thus an oak forest may be followed by another of the same kind.

Let us next suppose that no mature pines are present in the neighborhood—a condition which rarely occurs. In such a case the history of the tract depends on its level. If the tract is moderately low, seeds of Sweet Gum and Maple are apt to be sown on

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it, on account of the easy distribution of these by wind. But Maple seedlings cannot endure strong insolation, so that Sweet Gum and the more slowly distributed trees generally make their appearance. On high ground no tracts were observed which were devoid of pine, but it is probable that in such a case reforestation would be slow, and that oaks would form the prevailing growth, beginning with the most xerophytic species such as Spanish Oak and Post Oak.

It remains to be considered what is to be regarded as the climax forest formation of the region. It has been shown by Cowles* that extreme conditions such as xerophytic or the opposite tend to become more and more mesophytic. Extreme conditions are the sign of a young topography, while the mesophytic condition denotes that processes such as base-levelling have gone on for an extended period, leading to a comparatively stable condition of the flora which may be styled the climax flora for that region. Thus in Washington and Oregon a mesophytic coniferous forest prevails, while in the north-eastern states Maple-Beech forests are found in the most mesophytic situations. The same author offers good evidence for the view that the Maple-Beech formation succeeds the Oak-Hickory formation. It is proper to inquire, therefore, whether the Oak-Hickory formation of our District gives evidence of being replaced by some other, for instance, one containing Maple or Beech. My observations indicate that this is improbable for three reasons. (1) The maple in the district under study is *Acer rubrum,* while that in the northern Maple-Beech forests is *Acer saccharum.* The former is a tree of low ground, and only rarely spreads up the slopes into the oak stands. (2) If on the uplands maple and beech were succeeding the oaks, there should be found areas with a pronounced undergrowth of *Acer rubrum* and *Fagus americana;* such areas have not been observed. If the uplands should ever become sufficiently mesophytic to support these that time will be far into the future. (3) Observations as to the nature of the primeval forest of this region do not indicate that this consisted of a Maple-Beech combination. The oldest tracts of upland forest found in the district

*Cowles, H. C. The plant societies of Chicago and vicinity. Botanical Gazette, vol. xxxi, 1901; pp. 73-108, 145-182.

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consist of White Oak, Black Oak, Chestnut, Hickory and Beech, although these do not necessarily represent the composition of the primeval forest. It is of interest to note that Harshberger* finds in a tract of unaltered forest in south-eastern Pennsylvania not a Maple-Beech combination but a mixture of Tulip-tree, Chestnut, oaks, Beech and Hickory. The most mesophytic tracts of any extent, namely, on the Collington Sandy loam of the "Forest of Prince George," show a combination of White Oak, Black Oak, hickories and Tulip-tree, with Chestnut on the higher parts of slopes, and with seedlings of the same species. Hence such a combination, and not a Maple-Beech formation is to be considered the climax forest of the region.

Reforestation.—The process of natural reforestation has been described in the preceding paragraphs. That this is taking place over wide areas is hardly to be regretted, for much of the land in question has been largely drained of its humus by the long-continued growing of tobacco, sometimes on soil none too well adapted for this purpose. In time the soil will regain itself and may be cleared and again cultivated to advantage. In parts of the area the land might well be permanently retained in forest, for much of it is well suited to the growth of White Oak and other hardwoods, which are increasing in value by leaps and bounds. To this end some of the elementary principles of forestry should be regarded by the owners of tracts of woodland. Though forest succession is necessarily slow, a good deal can be accomplished in one lifetime, owing to the rapid growth of the pines. These will generally plant themselves over an area spontaneously, and in course of time as they mature they should be removed, probably by clean cutting, so as to admit light to the oak seedlings which it is taken for granted will appear beneath the pines. In order to ensure their appearing, planting of acorns might be resorted to with advantage. In the case of an Oak-Hickory forest, selective cutting should be employed, removing defective and deformed trees, also those of inferior species such as the Black Jack Oak and Spanish Oak, as well as the mature trees of desirable species. It is a good plan to cut from only a

*Bull. Torrey Club, vol. xxxi, 1904, p. 141.

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small area each year so that the woodman may complete the circuit of his forest in say ten years, and then cut again from the area first cut over. Among the advantages of this plan is the smaller damage done to seedlings by hauling the timber. Where Chestnut or the Tulip Tree are the important trees, the method of coppicing is desirable. The treatment of the Chestnut is the subject of a recent bulletin of the Department of Agriculture.*

MARSHES.

The term "marsh" is here used to include those hydrophytic areas where grasses or other herbaceous vegetation dominate, as do trees in what have been called "swamps." Two well-marked associations exist, depending on the salt content of the water, so that fresh and salt marshes may be considered separately, though transition or tension areas are easily to be found.

Fresh Marshes.

Fresh marshes occur along the shores of slow-running rivers and of ponds which are provided with an outlet. In case the banks are gently sloping, a well-marked zonation may be seen. Beginning with the zone which occupies the deepest water, there may be distinguished:

Potamogeton zone.—Several species of *Potamogeton,* especially *Potamogeton natans,* inhabit water 5 to 10 feet deep, which may flow with fair rapidity without destroying the plants. In quiet water such as ponds the *Potamogeton* is frequently accompanied by *Brasenia purpurea* and such free-swimming plants as *Utricularia. Lemna* and *Spirodela.* Other plants do not invade this zone on account of their inability to bring the leaf-blades to the surface of the water. This zone is often absent, owing, perhaps, to the too sudden descent of the river-bottom. Occurring in similar situations, though not with sufficient frequency to be listed separately, is *Vallisneria spiralis,* which was observed in inlets from the Gunpowder River.

*Bureau of Forestry, Bull. 53.

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Nymphaea zone.—In slightly shallower water (2 to 5 feet) there frequently occurs an almost pure growth of the yellow water-lily. Plate XIII, Fig. 1, illustrates a pond near Upper Marlborough, Prince George's County, in which four "islands" of *Nymphaea* are visible. The localization of these in limited areas must be due to variations in depth of the water, for in shallow ponds *Nymphaea* generally covers the whole area. The most striking feature of this photograph is the group in the foreground, which may be styled an atoll for it is plainly ring-shaped, probably owing to the cause already mentioned,—that is, greater depth of water in the middle of the group. On Romney Creek, Harford County, *Castalia odorata* was observed in the outer, deep zone together with *Polygonum sp.* and *Spirodela polyrhiza.*

Pontederia zone.—In still shallower water (1 to 2 feet) *Pontederia cordata* is of very frequent occurrence as a marginal plant, and it is successful as a pioneer along the edges of watercourses which are silting up. On account of its system of rhizomes and numerous roots it is able to hold its place in a moderate current. Good examples may be seen along the Anacostia River, near Washington. Associated with this is frequently found *Sagittaria latifolia* or *Sagittaria lancifolia.*

Zizania zone.—This zone is usually much broader than any of the preceding, and forms areas many acres in extent along such rivers as the Patapsco, the Patuxent (as far down as White's Landing; vide Scofield*) and the Gunpowder. It follows *Pontederia* on mud flats, hence is usually found a little farther back from the margin of a stream, though it is inundated constantly, to a depth varying with the condition of the tide. On account of the height of this grass it shades out most of its competitors, but on the margin of the stream it is mixed with *Pontederia,* and in very shallow water it is accompanied by *Bidens laevis, Polygonum sagittatum* and *Sagittaria.* This zone is tenanted by numerous birds who use the seed of *Zizania* as food.

*Scofield, C. S. U. S. Department of Agriculture, Bureau of Plant Industry. Bull. 72.

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Typha zone.—There is some reason to believe that *Typha latifolia* follows *Zizania* on mud flats, but in many localities it must be regarded as a pioneer. It is well adapted to fill this role on account of the easy distribution of its seeds. Like *Zizania* it often covers extensive areas. After *Typha* has occupied an area for a few years it is apt to be invaded by *Asclepias incarnata, Hibiscus moscheutos, Polygonum arifolium, Polygonum sagittatum, Impatiens biflora, Convolvulus sepium.* In such situations *Typha* may be partially replaced by groups of *Scirpus lacustris, Scirpus validus, Peltandra virginica, Orontium aquaticum* and *Iris versicolor.* As still drier conditions come to prevail, competition is more and more severe and the following plants may enter into the struggle:

Cephalanthus occidentalis
Triadenum virginicum
Saururus cernuus
Aeschynomene virginica
Eupatorium perfoliatum
Epilobium coloratum
Cuscuta sp.
Ambrosia trifida
Micrampelis lobata
Helenium autumnale.

Alder zone.—*Cephalanthus occidentalis* is often a pioneer shrub in such situations, but usually the Alder (*Alnus rugosa*) follows closely and becomes dominant. Many of the plants in the preceding list persist in this zone, for the shade of the Alder is not dense. Other shrubs generally accompany the Alder, e. g., *Rosa carolina, Ilex verticillata.*

Maple zone.—On considerably drier ground beyond the Alder flourishes the Red Maple, with which may be associated Black Willow, Buttonwood and Ash.

In any given locality several of these zones may be lacking, especially the first two. Very seldom is *Pontederia* absent, but the conditions may not be favorable for *Zizania* (*vide* Scofield, l. c.). *Typha* is not so exacting in its requirements, and is universally pres-

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ent. A plant which may occur in considerable numbers on the drier part of a margin, for example, behind the *Typha,* is *Phragmites phragmites;* rather large groups of which were seen on the Patapsco River near Baltimore. (Plate XIV., Fig. 2.) The zone in the foreground consists of *Ambrosia trifida.* The extent of such marshes depends on several factors, (1) steepness of slope of the river bank, and breadth of the flood-plain; in the case of most of the rivers of our district there is not a well-developed flood plain, but a comparatively narrow channel with gently sloping banks, hence the area available for a marsh is limited, and the tree zone is soon reached. (2) Rapidity of descent of the river channel, or in other words rapidity of flow of the river: the part of a river which flows through this district necessarily has a gentle slope, for the Patuxent is at Laurel less than 200 feet above sea-level, moreover tidewater backs up the rivers for a great distance, thus periodically destroying the flow in the lower reaches. These conditions are favorable for the deposit of sediment, which is the necessary concomitant of marsh formation. (3) Nature and quantity of the sediment brought down by the river, which depends partly on the last factor, but also on the nature of the country through which the river flows in its upper course. If sediment is very fine it may be carried to the mouth of a river instead of deposited along its channel. In most cases a mixed condition prevails, and the sediment is sorted out as it flows along. Marshes of the type here considered are partly the result and partly the cause of the silting up of rivers. After a storm much sediment is carried down a river, and as the water of the river resumes its normal level some of the sediment is deposited along the river's course, especially along the margin, where the current is slow. The water is thereby made shallow enough to permit the growth of such plants as *Pontederia* and *Sagittaria;* continued growth of these plants not only holds the sediment in place but helps to accumulate more. So the river becomes shallower and narrower, and as a consequence the navigable portion is restricted. The gradual raising of the level of the marsh is effected partly by the detritus deposited on the vegetation by spring freshets, and partly by the accumulation of dead plant re-

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FIG. 1.—VIEW SHOWING THE PEAT BOG AT GLENBURNIE, ANNE ARUNDEL COUNTY.

FIG. 2.—VIEW SHOWING MARSH WITH SALT MEADOW GRASS BEHIND WHICH IS SMOOTH MARSH GRASS, CHESAPEAKE BEACH, CALVERT COUNTY.

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mains. As the level rises, the line of shrubs and of trees advances steadily toward the stream.

Salt Marshes.

The requisite for a salt marsh is a shallow body of salt or brackish water which is not too much disturbed by littoral or fluvial currents or by wave action. Hence these associations occur at the mouths of streams and in embayments along a great part of the coast line of the district under consideration, i. e., along Chesapeake Bay, the Potomac and the Patuxent rivers. Areas of this kind were studied at Leonardtown, Chaptico and St. George's Island in St. Mary's County, Parkers Creek and various places along the Patuxent in Calvert County, West River and Patapsco River in Anne Arundel County, Bush River and Gunpowder River in Harford County. Since all the rivers of the region are tidal, the influence of the salt is felt for more or less distances up the rivers. Accordingly halophytic vegetation extends along the edges of the streams to a distance which depends on the width and slope of the channel and the distance from the mouth of the Bay.

The vegetation of the salt marshes is altogether distinctive, for only a limited number of species have adapted themselves to the unusual conditions which here prevail, viz: (1) a relatively high osmotic pressure of the water in the substratum, (2) a periodic rise and fall in the level of the water, (3) a soft and unstable substratum, and frequently (4) the deposit of sediment coming by means of river or shore currents. Among the plants which have acquired the ability to live amid such conditions are preeminently certain grasses of the genus *Spartina,* in which the following features are noteworthy: (1) their extensive system of stout rhizomes which securely hold the plant in the yielding substratum; (2) the well-developed papery sheaths of the leaves, which prevent free access of salt water; (3) the power of rolling up possessed by the leaves, tending to enclose the stomata and so check transpiration.

The last features and some others are shown in the photomicrographs on Plate XV of the leaf of *Spartina stricta* var. *maritima.* Fig. 1 represents a transverse section from the central

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region of the blade, magnified 12 times. It may be observed that the leaf is partly rolled up, with the upper surface inward. A small piece of the leaf is more highly magnified in Fig. 2 (x40), and it may now be seen that the upper surface of the leaf is deeply grooved by a series of depressions running lengthwise on the upper face. Vascular bundles of two ranks are present, situated in the areas marked out by the grooves. The internal structure can, however, be better made out in Fig. 3 (x80). Each bundle is encircled by a row of large cells which in the fresh state are seen to be either colorless or else scantily supplied with chloroplastids on the side away from the vascular bundle. These cells appear to function largely as water reservoirs. To the right and left of these storage cells are small cells richly provided with chloroplastids and separated by intercellular spaces—the spongy tissue of the leaf. This layer is well shown in Fig. 5. A band of mechanical tissue may be seen at each end of the group of storage cells, immediately beneath the upper and lower epidermis of the leaf. Thus in each of the units into which the leaf is divided there is a division of labor among the conducting, storage, assimilatory and mechanical tissues. At the foot of the grooves may be seen in several of the figures a group of rather large cells whose outline is irregular owing to collapse of the walls. These are the "bulliform cells," first described by Duval-Jouve,* and figured for many grasses, e. g., by Holm;† to their shrinkage and collapse is due the rolling up of the leaf when the water supply is scanty compared with transpiration. Beneath each group of "bulliform cells" there may be seen in a fresh specimen a large cavity bounded laterally by the green cells; in the preserved material these cavities almost entirely collapse, but indications of them are visible in several of the figures. The "bulliform cells" are rather small in the species under consideration, but their action is doubtless supplemented by the collapse of the cavities just described. The grooves next claim our attention. It will be noticed that their depth is a little less than half the thickness of the leaf, and in the curled leaf they are exceed-

*Ann. Sci. Nat. Bot., vol. vi, pt. 1, 1875, pp. 294-371.

†Holm, T. A study of some anatomical characters of North American Gramineae. Botan. Gaz., vol. xvi, 1891, p. 166.

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ingly narrow, having the form of slit-like grooves. Fig. 4 shows a stoma opening into a groove; it is slightly depressed below the surface of the epidermis, and communicates as usual with a cavity formed by an intercellular space in the spongy tissue. Stomata occur only in the grooves, but may occur at quite variable depths in a groove. No stomata are found on the lower surface of the leaf. The guard cells and the ordinary epidermal cells lining the groove are provided with peg-like projections, which serve to retain a quantity of air in the groove during the periods of submergence of the plant that are brought about by the tides. This adaptation is of prime importance to the plant, and is entirely effectual, as may be determined by mounting a section of the fresh leaf in water. As may be seen from Fig. 5, the vascular bundles are of the ordinary closed collateral type, with a heavy sheath around the phloem.

A detailed account of the adaptations of halophytic plants may be found in Kearney's admirable Report on a Botanical Survey of the Dismal Swamp Region, already cited. The following ecological grouping may be adopted:

Spartina stricta association.—On account of the ability of *Spartina stricta* var. *maritima* to live in water of a depth of one foot or more, it is a pioneer, and in places where it occurs it is constantly extending the outer line of the marsh. Moreover it will bear a greater amount of salt than will most of the other plants of a marsh, and possesses all of the characters mentioned in the preceding paragraph. The general appearance of the species is shown in Plate XVI., Fig. 2, and its activity as a pioneer in Plate XVII., Fig. 1, which represents the mouth of Mouldy Run, near Leonardtown (St. Mary's County). Here the Spartina is acting in conjunction with the sediment which is brought down by the stream, so that a delta is in process of formation. The writer was informed that thirty years ago this spot was clear water. Towards the outer edge of such a formation *Spartina* is the only plant, but as more silt collects other plants make their appearance, for example *Acnida cannabina,* a decidedly hemp-like plant, the lavender clusters of *Limonium carolinianum, Pluchea camphorata* with its strong-smelling foliage and purple flowers, and *Solidago sempervirens.* All

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of these are species which will bear a large proportion of salt in the substratum, and the contrast between halophytic and mesophytic species belonging to the same genus (*e. g. Solidago*) is striking.

The absence of *Salicornia* from this and other associations of this region is worthy of note, since in many maritime estuaries it is extremely common. Perhaps the explanation lies in the moderate percentage of salt present in the Chesapeake Bay and the Potomac, which is 1.638 as compared with 3.631 for the Atlantic Ocean, and this explanation is borne out by the observation that *Salicornia* occurs in the marshes at Ocean City. It is certain that *Salicornia* can grow in water which is even more salt than the sea, as in places where sea water is exposed to evaporation. Probably the competition of other plants has driven it out of the less salt marshes.

Spartina polystachya association.—This species is found in more or less pure stands as a zone bordering most of the tidal streams near their mouths. It prefers less salt than the preceding species, and grows with its roots and the lower part of its stems between tide. Its tall robust habit, and the prominent clusters of spikes are highly distinctive, and are shown in Plate XVII., Fig. 2, from the border of McIntosh Run, St. Mary's County, on which stream it stretches for about half a mile, replacing *Spartina stricta* at a short distance from the mouth of the stream. The growth here is so dense that other plants are excluded, but frequently *Scirpus robustus,* an extremely coarse looking sedge, is present in small numbers. When this association occurs somewhat farther up a stream, in places where a smaller proportion of salt is present, several other plants may accompany the *Spartina* as in the marsh on Chaptico Creek, St. Mary's County, represented in Plate XVIII., Fig. 1. In this figure a conspicuous plant of *Hibiscus moscheutos* may be seen, to the left of which are several specimens of *Asclepias incarnata* and *Strophostyles umbellata;* these together with the *Spartina* grow on a point between the main stream and a tributary.

Scirpus olneyi association.—In much the same habitat as the preceding occurs the sedge known locally as "three-square grass." Though it frequently grows on the border of a stream and thus fills

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the role of a pioneer as do the species of *Spartina,* it persists after the marsh has become somewhat drier, hence forming wide areas toward the land side of a marsh. It is more apt to grow in mixed association than are the species of *Spartina,* and may be accompanied by *Scirpus robustus, Cyperus strigosus, Acnida cannabina, Atriplex hastata, Lythrum lineare, Solidago sempervirens* and *Pluchea camphorata.* The last named plant imparts a purple hue to this association in late summer.

Distichlis association.—As sediment and vegetable matter accumulate, the level of the marsh rises, and the species of Spartina either do not find a suitable footing, or are crowded outward (*i. e.* toward the stream) by other grasses, chief among which is *Distichlis spicata.* This is a much finer textured grass and has a lower habit of growth. It grows in close mats, sometimes to the exclusion of other plants, as at the mouth of Parkers Creek, Calvert County, where *Distichlis* with a little *Spartina patens* occupies the foreground, while *Spartina stricta* occupies a deeper region farther back. Owing to the more mesophytic positions in which the *Distichlis* grows, it is generally accompanied by a variety of dicotyledonous plants such as *Lythrum lineare, Ptilimnium capillaceum, Polygonum sagittatum, Sabbatia stellaris, Gerardia maritima, Solidago sempervirens, Pluchea camphorata, Aster tenuifolius.* Hence it is apt to present a brighter and less monotonous appearance than the associations already described. This may be seen on Chaptico Creek, St. Mary's County.

Iva-Baccharis-Panicum association.—The two shrubby Compositae *Iva frutescens* and *Baccharis halimifolia* with much *Panicum virgatum* and a variety of other plants frequently occupy a higher and drier position than the preceding, on the landward margin of a marsh. *Iva* can apparently endure a moderately high proportion of salt, for it sometimes occurs as scattered individuals in the other associations, quite near the water, while *Baccharis* may persist after the tract has become dry and meadow-like. In the more open parts of this association may be found *Sabbatia stellaris, Pluchea camphorata, Strophostyles umbellata, Gerardia purpurea,* while *Willughbaea scandens* clambers over the shrubs and adorns them with

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its clusters of whitish flowers. Occurring frequently on the shrubs is a *Cuscuta,* which appears to find the conditions altogether suitable, judging by its luxuriance.

The phanerogamic representatives of the parasites which are found in this district may be briefly considered here. Of the genus *Cuscuta* at least two species occur, *Cuscuta gronovii* on various plants found in river valleys and low grounds generally, and the species referred to above, *Cuscuta polygonorum* usually growing on *Iva* and *Baccharis* near salt water. *Phoradendron flavescens,* the mistletoe, occurs in the "meadow" districts, e. g. southeast of West River, Anne Arundel County, and appears to prefer Black Gum as a host. *Leptamnium virginianum,* Beech Drops, occurs on the roots of *Fagus* in many parts of the region. This plant belongs to the class of root-parasites, as has long been suspected and recently established by Cooke and Schiveley.* The genus *Melampyrum* contains some root-parasites, as the researches of Heinricher have shown. *Melampyrum lineare* occurs plentifully in dry woods in our region, but of the specimens dug up none were found to be attached to other plants, though the writer is informed that farther north the plant behaves as a root-parasite. This species is probably able to live an independent existence. The species of *Gerardia* are said to be more or less root-parasitic, but the point has not been investigated in this connection. *Comandra umbellata,* reported from the vicinity of Baltimore, was not collected by the writer. Related to parasites are those plants which owe their nutrition to symbiotic fungi. Among these, *Monotropa uniflora* and *Hypopitys hypopitys* are distributed throughout the area, while the species of *Corallorhiza* are not so common (*Corallorhiza multiflora* was collected near Bowie, Prince George's County).

Typha association.—In less salt situations than any of the preceding, though by no means in the drier parts of a marsh, generally occur more or less extensive groups of *Typha angustifolia* or in some cases *Typha latifolia.* In cases where the groups occur near the mouth of a stream, the smaller proportion of salt is to be accounted

*Observations on the structure and development of *Epiphegus virginiana.* Trans. and Proc. Bot. Soc. of Penna., vol. i, 1904, pp. 352-398.

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for by seepage from the banks, or by the presence of a bar separating this part of the marsh from tide-water. In the latter case a practically fresh marsh may exist very near salt water as may be observed at Cove Point on Chesapeake Bay. As the area becomes drier it is invaded by a variety of dicotyledonous plants, conspicuous among which are the two malvaceous species *Hibiscus moscheutos* and *Kosteletzkya virginica.* In a marsh of this kind on Bush River Neck, Harford County, it was observed that the *Gerardia maritima* of the marshes farther down the Bay was replaced by *Gerardia purpurea,* and *Sabbatia stellaris* was replaced by *Sabbatia dodecandra.*

Juncus roemerianus occurs in considerable masses in several places, e. g. on St. Georges Island, southern St. Mary's County (also at Ocean City), but hardly warrants being placed as a distinct association, though Kearney (*op. cit.*) found it abundant in the Dismal Swamp region. *Spartina patens* also forms somewhat extensive mat-like groups in a similar habitat to and mixed with *Distichlis,* as was observed on Fishing Creek, Calvert County; it also occurs in a somewhat different habitat, namely, on the strand, where it usually grows taller. This larger plant is by some considered a distinct species,—*Spartina juncea.* Another plant found in very dry situations and also on the border of tidal streams is *Strophostyles umbellata.*

It may be gathered from the foregoing that the distribution of these associations depends: (1) on the amount of salt in the substratum, (2) on the water-content of the substratum. Hence a zonation may be observed (1) as one proceeds up a tidal stream, and (2) in the direction of the bank. In the latter case a distinct zonation occurs only when the formation of the marsh has been uniform and gradual. The zones are arranged as follows, though in no one place are all of them likely to be present:

I. Spartina stricta association
or Spartina polystachya assoc.
or Scirpus olneyi association
or Typha association
} Marginal zones determined by salt content, etc.

II. Scirpus olneyi association

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III. Distichlis association

IV. Iva-Baccharis-Panicum association

V. Shrubs and trees: Myrica, Rosa, Baccharis, Juniperus, Pinus taeda, etc.

In places where littoral currents are marked, a sand-bar is built up around the edge of the marsh, and on it are apt to be found *Spartina patens, Distichlis,* with scattered plants of *Iva* and *Solidago sempervirens,* and a fringe of *Spartina stricta* var. *maritima* in the water at the edge, while in the depressed area behind the bar *Scirpus olneyi, Spartina polystachya,* or *Typha* may predominate, according to conditions.

Transition areas.—In travelling up a tidal stream to regions where saline influences are less and less felt, an interesting succession of plants may be seen, one association replacing another until all traces of halophytic vegetation have disappeared. The degree of saltness which a species will endure varies within wide limits, some species being found only where the proportion of salt is about that of the open sea (3.5%), e. g. *Salicornia sp., Limonium carolinianum, Tissa marina,* so that their presence indicates to the eye the nature of the substratum. Other plants will endure only a minute amount of salt, for instance, Scofield (loc. cit.) finds that the limit for growth of *Zizania aquatica* is 0.374% of salt, while specimens are only occasional after a concentration of 0.175% is reached. Between these extremes lie most of the plants found in the salt marshes of the region under consideration. From a study of a number of streams and marshes the following list has been made, approximately arranged in descending order of salt resisting capacity:

Salicornia herbacea
Limonium carolinianum
Spartina stricta var. *maritima*
Spartina polystachya
Aster tenuifolius
Atriplex hastata
Solidago sempervirens
Acnida cannabina

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FIG. 1.—VIEW SHOWING SMOOTH MARSH GRASS FORMING A DELTA AT THE MOUTH OF MOULDY RUN, NEAR LEONARDTOWN, ST. MARY'S COUNTY.

FIG. 2.—VIEW SHOWING SALT REED GRASS ALONG M'INTOSH RUN, NEAR LEONARDTOWN, ST. MARY'S COUNTY.

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Scirpus olneyi
Scirpus robustus
Pluchea camphorata
Spartina patens
Distichlis spicata
Juncus roemerianus
Lythrum lineare
Gerardia purpurea
Sabbatia stellaris
Ptilimnium capillaceum
Lippia lanceolata
Kosteletzkya virginica
Iva frutescens
Hibiscus moscheutos
Pontederia cordata
Baccharis halimifolia
Panicum virgatum
Asclepias incarnata
Typha angustifolia
Polygonum hydropiper
Panicum walteri
Zizania aquatica
Lobelia cardinalis
Eupatorium coelestinum
Alnus rugosa
Myrica carolinensis
Rosa carolina
Sagittaria latifolia
Saururus cernuus
Bidens beckii.

A few species might well be styled "facultative halophytes," for they are found in both salt and fresh stations, for instance, *Hibiscus* and *Asclepias incarnata.* It has been shown by the writer* that the leaves of such plants have a different structure in the two habitats.

*Chrysler, M. A. Anatomical notes on certain strand plants. Botanical Gazette, vol. xxxvii, 1904, pp. 461-464.

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Reclamation.—In many places where the marshes are of considerable extent, all or part of the plant-covering is mowed off yearly, constituting the so-called marsh hay. That this crop varies greatly in value is sufficiently evident when the variety of plants enumerated in the foregoing pages is considered. Some of the species are useful only for bedding, as *Scirpus olneyi,* others are useful for thatching, as *Spartina polystachya,* while a few, namely, the finer textured grasses such as *Distichlis* and *Spartina patens* are fed to cattle. The coarser grasses and sedges are quite inferior for this purpose, though cattle will eat *Spartina polystachya* while it is young, and in fact wander of their own accord down into the marshes to graze, probably in order to satisfy their need for sodium salts. The value of marsh hay for feeding purposes is questioned by many residents; Mr. J. Key of Leonardtown showed the writer some cattle which had grazed partly on the uplands and partly in the marsh, and they were in excellent condition. It is a common practice in Southern Maryland to burn off the surface of the marshes in the autumn; it is claimed that this treatment improves the quality of the marsh hay. The improvement seems to result from the replacing of a growth of *Scirpus olneyi* by *Spartina polystachya* in the succeeding year. This practice is not to be commended, for it destroys the organic matter which has been built up by the plants.

From what has been said as to the superior value of *Distichlis* over *Spartina* and *Scirpus* as a fodder plant, it appears that any method whereby the first grass may be made to replace the others will increase the value of the marsh land. It has been mentioned earlier that *Distichlis* forms a zone behind *Spartina,* that is, in a drier situation. This fact suggests that *Distichlis* may be made to grow on a tract of marsh if this is drained. Experience proves the truth of this assumption; Mr. Key has extended simple ditches through one of his marshes and has in a few years seen the disappearance of the coarse grasses and the coming in of the finer textured ones; in other words the marsh is fast being reclaimed. Some tracts of marsh undoubtedly lie too low for drainage by this simple means, being submerged much of the time, but there are large tracts in the region which might easily be turned into good hay-producing land, and this is a matter of some importance in a section where hay is so scarce.

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The method of diking, so much in vogue along the Bay of Fundy, could be used with good effect in the low marshes, but in most cases all that is needed are simple ditches extended farther inland and dug deeper year by year until the system is just above low-tide mark. A desirable feature of such a system is a one-way gate or valve at the lower end of the ditch, for the purpose of preventing the running back of tide water into the ditches. Such a gate is very easy of construction.

PEAT BOGS.

Peat Bogs are characteristic of those parts of the continent which show abundant signs of recent glacial action, nevertheless an interesting example of a depression containing *Sphagnum* and a society of peat bog plants occurs near Glenburnie, Anne Arundel County. This area is of small extent (less than an acre) and is not a typical bog inasmuch as it is not undrained but rather slowly drained into a nearby stream. It derives its water from springs on the adjacent banks. Plate XVI, Fig. 1, illustrates the general features of this society, and shows a few of the plants, several of which have not been found elsewhere in the state. Associated with the *Sphagnum* is the characteristic bog plant *Sarracenia purpurea,* which may be made out in the illustration, also the equally characteristic *Drosera rotundifolia* and *Drosera intermedia, Lycopodium inundatum, Eriocaulon decangulare, Xyris caroliniana, Rhexia virginica, Utricularia vulgaris, Eriophorum virginicum,* and the common shrub of northern peat bogs *Chamaedaphne calyculata.* At the extreme left of the illustration may be seen part of a shallow pond; in this were found *Castalia odorata* and *Brasenia purpurea.* In this pond a thrifty colony of *Marsilea quadrifolia,* a native of the old world, has also been established. The margin of the bog is formed by *Clethra, Alnus, Decodon* and a few specimens of *Azalea nudiflora, Magnolia virginiana, Rhus vernix,* with several interesting plants of herbaceous habit: *Iris verna, Lilium canadense, Habenaria blephariglottis, Carex folliculata, Woodwardia areolata, Osmunda cinnamomea,* and *Osmunda regalis.* The shrub zone is followed by one in which Red Maple, Black Gum and Loblolly Pine prevail.*

*For several of the determinations I am indebted to a paper by Campbell E. Waters, reported in Science N. S., vol. xxii, 1905, p. 15.

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STRAND.

Although not of the same extent as those on the Atlantic coast, typical instances of strand associations occur at numerous places along the Chesapeake and Potomac, as at Rock Point, Charles County, Piney Point, St. Mary's County, Bay Ridge, Anne Arundel County and Chesapeake Beach, Calvert County. In these decidedly xorophytic situations plants are not numerous in either species or individuals, and show many adaptations to the severe conditions, a full account of which may be found in Kearney's Dismal Swamp paper. Usually a distinct zonation may be observed, for the conditions differ considerably at different distances from the shore.

The outer beach is usually devoid of vegetation. Algae cannot gain a foothold in the space between tides on account of the shifting nature of the sandy bottom, while the area just above high tide is exposed to alternate washing by waves and drying by the sun.

Zone 1.—The middle beach. Beyond the reach of the waves of summer though not those of winter are a few annuals whose tap roots enable them to gain a footing, and which can endure a certain amount of salt. Among these *Cakile edentula* with its fleshy leaves and rocket-like fruits is widely distributed but not numerous in individuals; *Salsola kali* also a fleshy-leaved plant, is more common; *Euphorbia polygonifolia* owes its persistence to its prostrate habit as well as to its relatively long tap-root. Besides these outliers, specimens of the conspicuous yellow horned poppy, *Glaucium glaucium,* were collected at Piney Point, Solomons, etc.

Zone 2.—Behind the area exposed to winter waves is one in which a few perennials as well as annuals are able to establish themselves. Grasses such as *Spartina patens* and *Ammophila arenaria* form small clumps, while *Capriola dactylon,*—one of the few introduced plants found on the strand,—sometimes occupies rather large areas. Its habit of creeping and taking root at the nodes, together with its power of withstanding drought, eminently fit it for capturing such an area. Another grass of this zone, fortunately not occurring in extended groups, is *Cenchrus tribuloides.* Plants of prostrate or

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straggling habit found in this zone are *Strophostyles umbellata, Diodia teres, Polygonum maritimum* and *Atriplex hastata.* In some cases *Onagra biennis, Melilotus alba* and *Xanthium canadense* venture out into this zone.

Zone 3.—On higher ground, frequently very gravelly, a somewhat different assemblage is found, though this zone is not always clearly marked off from the preceding. Where gravel is abundant, *Chondrilla juncea* is the dominant plant of this area, but *Leptilon canadense* and *Capriola dactylon* are frequent, and *Xanthium canadense, Diodia teres, Echium vulgare* and *Opuntia opuntia* make up an assemblage notable for their prickly character. *Euphorbia ipecacuanhae* was found on the sand at Cove Point, Calvert County, and *Panicum amarum* at Turkey Point, Anne Arundel County, in similar position to the preceding. As a little humus accumulates, *Phytolacca decandra, Saponaria officinalis, Plantago lanceolata* make their appearance, while *Asparagus officinalis* escapes from cultivation and even seems to be able to grow in soil containing a fair proportion of salt.

An inner beach consisting of movable or stationary dunes was not observed bordering on the comparatively very quiet waters of the Chesapeake and Potomac, but at Turkey Point some small dunes, 4 to 10 feet in diameter, were seen, and they presented the unusual feature of being held together by *Spartina patens* rather than by *Ammophila arenaria,* which is the sand-binder of the dunes at Ocean City.

The marginal trees of areas bordering on salt water may properly be mentioned here. Red Cedar comes as near to the shore as any of the trees invading the zone occupied by *Baccharis, Myrica* and *Rosa.* Both Red Cedar and Persimmon occur as much stunted individuals on the middle beach. Yellow Locust also occurs in exposed situations, as may be well seen on Poole's Island, off Gunpowder Neck, Harford County, where it replaces the pines. It is a common tree of bluffs which overlook the Bay, as at Chesapeake Beach. In similar situations the Hackberry may occur, also either of the pines, especially the Loblolly in the southern part of the district. Other trees of less frequent occurrence near salt water are: Sweet Gum, Ash, Buttonwood and American Elm. The unfavorable

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factor in this habitat is salt winds rather than salt soil. The conditions in this district are however nowhere severe, as is shown by the absence of trees deformed by the action of strong winds. It is necessary in such situations to distinguish between trees which are pioneers and those which are relicts, for on an eroding shore the latter sort may be in the majority if they are rugged enough to withstand the increased rigor of the conditions. This is true for example of Spanish Oak and Chestnut Oak. On a peninsula nearly surrounded by marsh in south-eastern Anne Arundel County were found small poles of the Spanish, Post and Black Oaks, Scrub Pine and Sassafras, all of which with the possible exception of the pines are to be regarded as relicts.

The vegetation of islands is sometimes of much interest and significance. On account of the dynamic conditions already mentioned, the islands of this district have in most cases formed part of the mainland at no very remote date. This is true for instance of Pooles Island, off the tip of Gunpowder Neck. The most notable feature of the vegetation of this island is the total absence of pines. As already mentioned Yellow Locust is the dominant tree on the inner strand; farther in are Sweet Gum and scattered specimens of Willows, Persimmon, Huckleberry, Sassafras, Swamp, Black and Chestnut Oaks, Tulip-Tree, Hickory, Walnut and Black Gum. The only conifer found on the island is the Red Cedar. In accord with the position of the island well up toward the head of the Bay, the marsh vegetation is not of a pronounced halophytic character, for instance, *Spartina polystachya* occurs rather than *Spartina stricta,* and such salt lovers as *Solidago sempervirens* and *Pluchea camphorata* are associated with *Hibiscus* and *Typha.* Spry Island, near this, is a small low tract covered with grasses and sedges such as *Scirpus americanus, Panicum virgatum, Spartina polystachya,* with some *Hibiscus* and *Iva.* No trees are present.

St. George's Island, near the mouth of St. Mary's River in southern St. Mary's County, presents several points of contrast to the foregoing, in that the dominant tree is Loblolly Pine, which occurs in pure stands and also mixed with Sweet Gum or with Spanish Oak. Part of the island is cleared and devoted to agricultural purposes, while a large part is occupied by a marsh in which *Distichlis spicata*

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and *Juncus roemerianus* prevail. The abundance of Loblolly Pine here is partly due to proximity to its center of distribution.

Of a still different type are the rather precipitous small islands in Rhode River, Anne Arundel County. On these the arboreal growth is abundant and varied with oaks dominating. Besides the more common oaks (*Quercus velutina, Quercus digitata* and *Quercus alba*) *Quercus michauxii* is found here. This species occurs also on the adjacent mainland. Other trees found on the higher parts of these islands are: hickories, Ash, Red Maple, Dogwood, Huckleberry, Sweet Gum, Beech, Scrub Pine, with thickets of Smilax. These islands seem to be fragments of the mainland cut off by the wave action which is much in evidence in this vicinity. Hence one is not surprised to find vegetation similar to that on the mainland but lacking in a few species which find the exposed conditions too trying.

PLANTS OF CULTIVATED GROUND.

This title is used in a broad sense, to include the vegetation of all areas which have been frequently disturbed by man.

Roadsides.—In many parts of the district these are given scant attention, and hence are well supplied with trees of quick-growing habit, the kinds depending on the nature of the adjacent forests. In localities where the roads are better cared for, certain trees are left on account of their value for fruit or shade and may reach a great size. Owing to the ease with which Scrub Pine distributes its seed, and the capability it possesses of enduring insolation, it readily establishes itself along roadsides. The Red Cedar has been planted by birds so extensively along fences that in some localities living fence posts have come to replace the old decayed ones. This tree occurs in two rather distinct forms, one a tall spindle shaped tree, almost as slender as a Lombardy poplar, the other a much broader rounder tree. The two forms occur in different sections of the state, but just what determines the difference in form remains to be found out. Taxonomists do not recognize any varietal difference; possibly it is merely a difference in age, the round form being older. The next commonest tree of roadsides, especially towards the coast, is

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the Yellow Locust, although it is plentiful also in the interior. Isolated specimens of Persimmon, sometimes of large size, are frequent on roadsides and in fields. Some very large and old trees of Crab Cherry and of Red Mulberry occur along roadside fences. Other trees of the roadside are Sweet Gum, Spanish Oak and Hackberry. But it is the shrubs and vines which in Southern Maryland give character to the roadsides. For long distances the roads are literally lined by a dense growth of *Rhus copallina* or *Rhus glabra, Rubus villosus, Rosa sp.,* with young plants of Sassafras, Persimmon and Sweet Gum. Over these and over the fences climb large numbers of plants of *Vitis, Rhus, Smilax* and *Tecoma,* sometimes completely hiding some of the shrubs and even trees. Even where vegetation is not so abundant it is usual to see every fence post decorated by one or more vines of *Rhus, Smilax* or *Parthenocissus. Lonicera japonica* grows luxuriantly but is not apt to climb as high as the other lianes mentioned; it frequently covers banks and has indeed become a troublesome weed. Another plant characteristic of thickets and edges of woods is Hercules Club (*Aralia spinosa*) a species of arboreal habit and decidedly tropical appearance, which is rather common except in the northern part of the district. On dry sandy roadsides are to be found the Chicksaw Plum and the Chinquapin.

Since arboreal growth is so general along roadsides, the herbaceous vegetation is to a considerable extent similar to that of the adjoining forests. Where the trees and shrubs are cleared out, a more xerophytic assemblage makes its appearance. Most of the plants of such situations are indigenous, and only in the streets of villages are introduced species able to drive out the native ones. A convenient classification is on the basis of water content of the soil.

1. *Xerophytic:* Three ferns are common, *Pteris aquilina, Dryopteris acrostichoides* and *Asplenium platyneuron,* the last two preferring shady banks. In the earlier part of the season *Cassia nictitans, Baptisia tinctoria, Lespedeza virginica, Lepidium virginicum* and *Polygonum aviculare* are prominent, and are largely replaced later by composites such as *Aster ericoides, Sericocarpus asteroides, *Chrysanthemum leucanthemum, *Anthemis cotula,*

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FIG. 1.—VIEW SHOWING SALT REED GRASS, ROSE MALLOW AND SWAMP MILKWEED ON THE BORDER OF A TIDAL STREAM, CHAPTICO, ST. MARY'S COUNTY.

FIG. 2.—VIEW SHOWING GRAPE CLIMBING OVER LOCUST TREES, JAPANESE HONEYSUCKLE IN THE FOREGROUND, NEAR UPPER MARLBORO, PRINCE GEORGE'S COUNTY.

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**Chondrilla juncea.* In the region about three miles west of Annapolis **Cytisus scoparius,* the Scotch broom, has established itself along the highway and railroad, and seems to be spreading. This shrub though ornamental is apt to become a pest, as is the case on Naushon Island, Mass., where it has captured large tracts of exposed hillside, occupying them to the exclusion of other more desirable plants such as pasture grasses. Prompt steps should therefore be taken to eradicate the plant from Anne Arundel County.

2. *Meso-xerophytic:* Among the plants of early summer *Cassia chamaechrista, Oxalis spp., *Melilotus alba, *Trifolium pratense, *Saponaria officinalis, Potentilla canadensis,* and especially **Daucus carota* are prevalent; later *Lespedeza stuvei, *Lespedeza striata, Euphorbia corollata, *Plantago major, *Plantago lanceolata, *Rumex crispus, Phytolacca decandra, Solanum carolinianum, *Verbascum thapsus, Asclepias cornuti, Apocynum cannabinum* and *Lobelia inflata* make their appearance, followed by **Clinopodium nepeta, Solidago serotina* and others, *Euthamia graminifolia, Ambrosia artemisiaefolia, Achillea millefolium, Chrysopsis mariana, *Arctium lappa* and *Carduus lanceolatus.*

3. *Meso-hydrophytic:* In early summer **Allium vineale, Commelina nudiflora* and *Prunella vulgaris* in open places, with **Polygonum persicaria* in ditches, are common. A little later *Verbena hastata, Verbena urticifolia, *Nepeta cataria, *Glechoma hederacea, Koellia flexuosa, Mimulus ringens, Eupatorium perfoliatum, Eupatorium purpureum, Eupatorium coelestinum, Vernonia noveboracense, Bidens beckii* and *Ambrosia trifida* make a more conspicuous covering to the moist places.

Ruderal vegetation. The plants of rubbish heaps and of dooryards are included under this head. Although corresponding rather closely to the plants of village streets, a few should be specially mentioned here. All are widely distributed, and most of them are introduced species. *Polygonum aviculare* and *Plantago major* are common in paths; *Ambrosia artemisiaefolia, Xanthium spinosum, Amaranthus retroflexus, Amaranthus spinosus* occupy corners of

*Indicates introduced species.

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yards, while *Datura tatula* and *Xanthium canadense* are apt to prefer rubbish piles.

Weeds.—The majority of the noxious weeds found in fields while under cultivation are of foreign origin. The Bermuda grass, **Capriola dactylon,* is especially common in the drier parts of Southern Maryland. On the truck farms of Anne Arundel County **Echium vulgare, *Amaranthus retroflexus, *Chenopodium album, *Portulaca oleracea,* with the grasses **Syntherisma sanguinalis, *Ixophorus glaucus, *Panicum crus-galli, Cenchrus tribuloides* are more or less plentiful. Near Baltimore a field badly infested by **Brassica arvensis* was seen. **Plantago lanceolata, Solanum carolinense, *Daucus carota, Ambrosia artemisiaefolia* are only too common throughout the region. If a field is allowed to rest from cultivation for a year, native species begin to gain the ascendency. In the earlier part of the season a society is apt to appear in which no one species prevails; it may include **Allium vineale, *Rumex acetosella, *Trifolium arvense, Diodia teres, *Plantago lanceolata, Cassia chamaechrista,* and many others. A little later **Daucus carota* may become dominant, and still later a field may be practically covered by *Ambrosia artemisiaefolia.* The history of such a field in succeeding years may show great variation. Even in a pasture as is pointed out by DeVries* the same grasses do not grow year after year, but the sorts which are dominant depend on climatic features such as rainfall and temperature at the time of year which may be critical for any particular species. In the southern part of our district, fields which had lain idle for one or more years were found to be occupied by *Leptilon canadense,* others with *Monarda punctata,* while still others were largely covered by *Onagra biennis* or by *Euthamia graminifolia.* Other plants common in such areas are **Allium vineale, *Trifolium arvense, Strophostyles umbellata, Strophostyles helvola, *Daucus carota, Lepidium virginicum, Oxalis stricta, *Plantago lanceolata, *Verbascum thapsus, *Echium vulgare, Erigeron ramosus, Ambrosia artemisiaefolia, Achillea millefolium.* In case a neglected field is very sandy, the dominant plants are apt to be **Chondrilla juncea, Euphorbia corollata, Diodia teres, Cen-*

*DeVries, H. Species and Varieties, their origin by Mutation, p. 103.

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chrus tribuloides, Monarda punctata and *Lespedeza sp.* If a field lies fallow for a longer time, say, three or four years, woody plants become evident, for example, trailing vines such as *Rubus canadensis, *Lonicera japonica, Tecoma radicans* and *Smilax sp.*, shrubs such as *Rubus villosus* and *Rhus copallina,* trees such as *Pinus virginiana* or *Pinus taeda, Robinia pseudacacia* and *Diospyros virginiana.* Just what trees make their appearance depends largely on the species found in the immediate vicinity. As in the case of herbaceous plants, invasion is most rapid in the case of those species whose seeds are easily carried by the wind.

Burned areas may be briefly considered as a supplement to the foregoing. The first plants which appear are necessarily of xerophytic habit, since the humus of the soil is generally destroyed by the fire, and danger from exposure to strong insolation, etc., is great. Readiness of distribution by wind also is a determining factor. Among the pioneers are: *Diodia teres, Ambrosia artemisiaefolia, Chamaenerion angustifolium* (fireweed), *Cassia nictitans, *Lespedeza striata, Coreopsis verticillata.* Another class sure to be represented in the year following devastation includes plants whose subterranean parts escape destruction: *Pteris aquilina, *Rumex acetosella, Baptisia tinctoria, Lupinus perennis, Sericocarpus asteroides.* Shrubs are almost sure to make their appearance in a few years, as for example, *Vaccinium sp., Pieris mariana, Clethra alnifolia* and *Azalea nudiflora.* The arboreal vegetation sometimes escapes with slight damage, so that pines and oaks are frequently found standing. Young growth of the same species may spring up, but the Scrub Oak and Black Jack are apt to appear also. Fortunately forest fires are of rare occurrence in the region, so that only a few areas were found for the study of this topic. Hence the results are fragmentary.

RELATION OF VEGETATION TO SOIL.

The belief is widespread that the fertility of a soil may be judged from an inspection of the natural vegetation growing upon it. That the method is of limited application is seen from the fact that in Southern Maryland a tract covered with pine indicates in general

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not a barren tract but one which has recently been released from cultivation. Thus in any but a virgin forest, the historical factor as it may be called must be considered. In other words, it is necessary to ascertain how long the area has remained undisturbed. But conversely, the rapidity with which succession proceeds on any given tract depends on the character of the soil; soils markedly deficient in humus acquire but slowly the humus requisite for the support of a mesophytic type of vegetation. One of the objects constantly kept to the front in the progress of this Survey was the establishing of a relation between the various types of soil and the vegetation upon them. Yet a perusal of this chapter will show that the forests have not been grouped in accordance with the thirteen or more types of soil found in the region, for there is satisfactory evidence for believing that on the same tract several types of forest may follow one another, and further that these same forest types may occur on soils as different from one another as clay and sand. In spite of the variety of soils, the water content seems to be the most potent edaphic factor; the differences in the vegetation supported by a light and heavy soil, when both are placed in similar conditions as regards drainage, are trifling compared with the differences between upland and lowland vegetation.

One matter which has rendered the study of this problem difficult is the old enemy of two variable factors. It may be seen from an inspection of the soil maps* that any particular kind of soil is apt to occupy a fixed topographic position. For example, in St. Mary's County the Leonardtown Loam uniformly occupies high ground and is usually drained by a layer of Susquehanna Gravel underlying it, while Sassafras Sandy loam just as regularly occupies low ground, so that we cannot be sure that if Leonardtown Loam occurred at a low level it would not have the same vegetation as the Sassafras Sandy loam. But it has been possible to pick out areas of a number of soils occupying situations which are at any rate similar, even if not identical. A comparison of the vegetation of these areas has not revealed differences of a very striking nature. The really

*U. S. Department of Agriculture, Bureau of Soils, Reports for 1900 and 1901.

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well marked plant formations are uplands, lowlands (meadow), fresh marsh and swamp, and salt marsh. In determining this classification there is apparently (1) a physical factor—difference in level, bringing about a difference in water content, and (2) a chemical factor—the proportion of salt in the substratum.

Whether the minor differences in plant covering shown by areas at about the same level are to be attributed to differences in the chemical nature of the soils is the subject of a long standing dispute which has waged with more or less acrimony since the time of Thurman (1849). The present writer has come to the conclusion that the district under consideration is not well adapted to throw light on this vexed question. One reason for this is that the soils of the district have been so often worked over by the action of rivers, waves, etc., that they no longer show marked chemical differences. The period which has elapsed since the soil particles were parts of a solid rock mass is so long that the more easily soluble constituents have been washed out, leaving the soils similar, except in the size of the particles. Only in a region where the soil is of a residual nature, i. e., overlies the rock from which it has been derived by weathering, can we expect to find peculiarities in chemical composition. Thus the layer of soil overlying limestone is more or less impregnated with calcium salts. An exceedingly favorable locality for the examination of the effect of the chemical factor has recently been studied by Fernald,* who has compared the vegetation of areas overlying potassic rocks (gneiss), calcareous rocks (limestone) and magnesic rocks (serpentine) as found on Mt. Albert, Gaspé, Quebec. This writer finds that while some species are indifferent, a number are characteristic of one or another of the three sorts of soil, and to a certain degree irrespective of drainage. In our district the only soil which is of a residual nature is the Collington Sandy Loam, which has been derived by weathering from the glauconite or greensand upon which it rests. Even in this case the soil has largely lost the potash which is a characteristic element of glauconite.† It may be said, however, that the Collington Sandy Loam

*Fernald, M. L. The soil preferences of certain alpine and subalpine plants. Rhodora, vol. ix, 1907, pp. 149-193.

†See Soil Survey Report for 1901, p. 186.

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supports the most mesophytic vegetation of any of the upland soils, and its merits are attested by the presence of nurseries and by the large areas under cultivation.

The nature of the forest growth now found on some tracts in this district seems to be due not only to the fact that it represents an early stage in the process of succession, but to the fact that the tracts have been used for so long a time for the growing of tobacco that the supply of certain soil constituents, as for example, lime, has become exhausted. The importance of the preservation of a balance among the various soil solutes has been shown by Osterhout* who finds that magnesium and potassium salts used separately are poisonous to plants, but when mixed together the poisonous effects disappear. Apart from the practical suggestion that these soils may be improved by application of lime and of green manure, the inference to be drawn from these facts is that we are here dealing with complex conditions, hence the following statements must be made with reserve.

Susquehanna clays. On this hard and impervious soil the vegetation is scanty and of a xerophytic character, except where a covering of humus has been accumulated. The Black Jack Oak is especially characteristic, with much Scrub Pine, also in smaller numbers oaks of other species. Chestnut, Hickory and Dogwood are hardly represented. Plate XXXVI., Fig. 2, gives a fair idea of the clay country near Bowie, Prince George's County, on the line of the Pennsylvania Railroad. The trees shown are Scrub Pine and Black Jack Oak.

Leonardtown Loam. This is known in some localities as "White Oak Land." It undoubtedly supports much of this species, but is characterized just as truly by Post Oak and Spanish Oak and by Scrub Pine and Sweet Gum. Black Oak, Hickory and Dogwood occur commonly; Black Jack Oak is found with Scrub Pine in xerophytic situations, while Loblolly Pine is common locally.

Collington Sandy Loam. This soil shows the most mesophytic vegetation of the region; White, Black and Red Oaks, Hickory and on the slopes, Beech and Tulip Tree, form the leading plant cov-

*Osterhout, W. J. The antagonistic action of magnesium and potassium. Botan. Gaz., vol. xlv, 1908, pp. 117-124.

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ering. Absence of pines except on xerophytic bluffs, of Black Jack Oak, and scarcity of Sweet Gum and Spanish Oak, also characterize this soil.

Sassafras Loam. Highly characteristic are White Oak, Sweet Gum, and Red Maple, while the Black, Swamp, Chestnut and Willow Oaks are plentiful. Black Gum usually accompanies the Sweet Gum and Maple.

Windsor and Norfolk Sand. Scrub Pine is more apt to occur as a lasting stand on the sand than on the heavy loam. Chestnut and Chinquapin are especially characteristic. The White, Post and Spanish Oaks and Yellow Locust occur frequently; the Tulip Tree is especially apt to occur on moist slopes.

Susquehanna Gravel. Under the highly xerophytic conditions caused by this soil only Scrub Pine and Spanish Oak occur with frequency.

Meadow. By far the commonest tree is the Sweet Gum, although near the coast in the southern part of the state, the Loblolly Pine is very abundant. The Willow Oak is highly characteristic of this region, while the White Oak is common though not characteristic. The position of the streams is marked by an exclusive growth of Alder, River Birch, Willows and Maple. Chestnut and the Tulip Tree rarely occur, while Hickory is by no means common.

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THE ECOLOGICAL PLANT GEOGRAPHY OF MARYLAND, MIDLAND ZONE; LOWER MIDLAND DISTRICT

BY

FORREST SHREVE

Introductory.

As contrasted with the Coastal Zone the Lower Midland District is very uniform throughout in its physical conditions, and it is the least diversified in its vegetation of any of the ecological districts of the state. Whereas the topography of the Coastal Zone is such as to present a number of types of Marshes and Swamps, to say nothing of the sharp contrast in soils, the Lower Midland has been eroded with such uniformity that differences of topography are responsible for only minor distinctions of habitat. By far the most important differential factors in determining the local distribution and association of plant life in this District are those concerned in the character of the soils. In the Introduction attention has already been called to the types of soil which overlie the various geological formations of the Piedmont Plateau, and to the fact that the chemical as well as the physical characteristics of these soils play an important role in relation to plant life. The influence of the topography is not inconsiderable, but operates in a similar manner on each of the major soil types. On the topland* the influence of the soil character is most marked, while on the lower slopes the factors determined by the topography exercise a predominant influence or even offset completely that of the soil character.

The two northernmost counties, Cecil and Harford, have been mapped by the Bureau of soils in cooperation with the Maryland

*_Topland_ is a word here used (and perhaps invented) to indicate that level or nearly level part of the surface of a maturely dissected topography which lies at or near the highest elevation, in contradistinction to the middle and lower slopes of the valleys.

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Geological Survey, where one of the most striking characteristics of the district has been brought out, namely the close correspondence between the distribution of the soils and that of the geological formations. The several outcrops lie parallel to the general length of the district, so that it is possible, in terms of the conditions in the above-named counties to interpret the soils of the other counties in the technical nomenclature used upon the Soil maps.

The soils which cover the greatest area are the Cecil loam and the Cecil mica loam, derived from granite, gneiss and diorite of Archean or Paleozoic age. While distinct from the standpoint of the soil physicist, these two types, which differ only in the presence of mica fragments in the latter, are identical so far as their texture bears any relation to the amount and availability of soil water. The vegetation of the loams is that which is most typical of the Lower Midland District, not only because these soils are the most extensive in area, but because of the variety and richness of the arboreal and herbaceous flora, favored by the optimum soil conditions which they present. Second in extent are the areas of Cecil clay, derived from the weathering of gabbro, of which the largest lie directly west of Baltimore and in Harford County. There is not a very great difference between the Clay and loam vegetation, the former differing from the latter chiefly in the rarity and absence of certain plants which are more abundant on sands and other lighter soils. Relatively small areas are underlaid by serpentine, which either weathers to the Conowingo clay or presents the thin-soiled areas known as Serpentine Barrens. These occur in every county along a narrow line extending from a point where the Susquehanna enters the state to the banks of the Potomac just above the Great Falls. Their vegetation is well known as being very distinct, both through the abundance of species not common elsewhere and the absence of a large part of the flora of the surrounding soils. In Baltimore County there is an area in which marble forms the underlying rock, extending from Towson to Cockeysville, with irregular arms to the east and west. This interesting area is entirely under cultivation wherever it is not covered by Cretaceous or Pleistocene deposits, and the natural vegetation of its agriculturally rich clay soil is therefore unknown. The cretaceous deposits which

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occur in irregular and scattered areas along the edge of the District that is bounded by the "Fall-line" are usually in the form of homogeneous beds of gravel, or in some localities are lacking in boulders and pebbles, possessing a fine clay texture,—the Susquehanna clay of the Soil Survey. The vegetation of the Susquehanna gravel and the Susquehanna clay is almost as marked as that of the Serpentine Barrens, particularly on the hills. It is notable that the Lower Midland District contains no outcroppings of shale or sandstone, which are the two commonest underlying rocks throughout the Upper Midland District and the Mountain Zone.

The dominant natural vegetation of the Lower Midland District is a deciduous forest, in which, on the loam soils, the characteristic trees are the Chestnut, the Black Oak, the White Oak, the Chestnut Oak, the Scarlet Oak, the Mockernut Hickory, and the Pignut Hickory. In all of the deeper loam soils, particularly on lower slopes, there are numerous tree species in addition to the above, among which the Tulip Tree, the Beech, the Red Maple, the Bitternut Hickory, the Black Walnut and the Black Gum are prominent. In the Flood Plains there are additional species, as the Swamp Oak, the River Birch, the White Ash, the White Willow and the Hornbeam. The coniferous trees are but five in number,—the Hemlock, the White Pine, the Pitch Pine, the Scrub Pine and the Red Cedar, of which the last two are the only common species. Pure stands of Scrub Pine are frequently to be met with on upper slopes, but are usually young, and seem merely to represent the earliest stage in the reforestation of areas formerly occupied by deciduous forest. On many very steep rocky slopes, however, the Scrub Pine is to be found on what is apparently a natural habitat for it. The Pitch Pine is occasional in its occurrence throughout the District, but is seldom abundant except on the gravel and clay areas of the Cretaceous deposits. The Hemlock and White Pine are confined to rocky ravine slopes, where they were much more abundant in the virgin condition of the country. The Red Cedar, although now widespread, is found naturally only on the Serpentine Barrens and very steep rocky slopes.

The Cecil clay forests are somewhat different in composition from those of the loams, although the same species are involved in their

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make-up. The Chestnut Oak is very rare and the White Oak, the Tulip Tree and the Swamp Oak are much more abundant on the topland here than they are on the loam. The Serpentine Barrens are occupied almost solely by an open stand of Black Jack Oak, Post Oak and Red Cedar, although some of the commoner trees of the loams and clay occur on the deeper areas of Conowingo clay. The gravel and clay soils of the Cretaceous deposits are characterized by a forest of Chestnut and Chestnut Oak, with an accompaniment of xerophilous shrubs and herbs.

A comparison of the soil-covered slopes along Deer Creek in Harford County, on the loam soils in the vicinity of Glenville and on the Clay in the vicinity of Kalmia showed the topography to outweigh the soil as a factor in determining the make-up of the vegetation. Even on the Serpentine Barrens the topography plays an important part in bringing the vegetation of the lower slopes to a character more nearly approaching that of the lower slopes of the other soil types than that of the thin-soiled topland of the Barrens. On the gravel the influence of topography is considerable, but not so great as on the Serpentine; the lower slopes of Gravel hills are not closely related in flora to the lower slopes on the other soil types.

The fact that the vegetation of the soil-covered slopes, as well as of rock outcrops and flood plains is identical on the loams and on Cecil clay will make it unnecessary to treat these features separately for the clay.

Vegetation of the Loam.

TOPLAND.

There is no remaining virgin forest in the Lower Midland District and the bulk of the woodland is in small tracts scattered through a highly cultivated farming country. The steepness of many hillsides is responsible for their having been left in timber, and the Serpentine Barrens and Gravel hills have not been cultivated on account of the poverty of their soils. On a few old estates there are bodies of timber that have been undisturbed for half a century, a lapse of time which has enabled the trees to attain to a splendid size but

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has been far too brief to allow the natural operation of succession to bring the forest to a composition differing from that which existed when the groves were first left undisturbed. The selection of the most valuable trees for cutting, or the desire to leave particular species for shade or other purposes, determined the composition of the groves from which these old stands have grown. There are indeed no tracts of forest in the district in which the process of human selection has not been going on, usually in very recent years, so that the forest composition of to-day presents a bewildering variety, out of which it is difficult, even by extended comparisons, to reconstruct the composition of the original forests of the area. The commonest tree of the Lower Midland to-day is the Chestnut, but it is altogether likely that its ability to send up suckers from stumps, together with the very rapid growth of the suckers as compared with the slow growth of oak seedlings, or even oak suckers, is responsible for its predominance. In like manner the Yellow Locust has become a frequent tree merely through its readiness of reproduction.

In spite of these considerations the attempt was made to find what combination of trees represents the make-up of the oldest stands of the district at the present time, for the variety of the different tracts may be but little greater than would have been found in separated tracts of the virgin forest. In selecting areas for exact determinations of composition it was not the oldest that were taken, but those stands of trees from 30 to 60 years of age in which competition between the different species might be thought to have taken place to at least some extent.

Near Glenville, in Harford County, is a tract which has what comes near being the average composition of all the tracts carefully examined. In it the Chestnut is the predominant tree, the Hickories and Oaks forming nearly all the remaining percentage, the Chestnut Oak being absent. Its make-up is as follows:

Chestnut	35%
White Oak	20%
Mockernut Hickory	15%
Black Oak	10%
Pignut Hickory	10%
Bitternut Hickory	3%
Black Walnut	3%
Tulip Tree	2%
Beech	1%
Miscellaneous	1%

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Near Principio, in Cecil County, a tract was examined in which the Chestnut was uncommon, and the bulk of the stand was made up of Oaks, with the Chestnut Oak in the lead. The percentages were as follows:

Chestnut Oak	35%
Black Oak	20%
Scarlet Oak	18%
White Oak	10%
Swamp Oak	6%
Chestnut	6%
Mockernut Hickory	4%

A recapitulation of the percentages of species in six of the most typical stands examined on Cecil loam and Cecil mica loam in Cecil and Harford counties is as follows:

Chestnut	24%
Black Oak	18%
White Oak	15%
Mockernut Hickory	10%
Chestnut Oak	9%
Pignut Hickory	6%
Scarlet Oak	6%
Tulip Tree	5%
Swamp Oak	2%
Beech	2%
Miscellaneous	3%

The predominance of the Chestnut is, as stated before, no doubt unnatural, although it must always have been an important tree in the forest make-up. The White Oak and the Mockernut Hickory are the species which typify the deepest soils and the finest timber tracts of to-day (as at Glenville). The Chestnut Oak and Scarlet Oak are species more capable of enduring adverse soil conditions, as witness the abundance of the former on rocky slopes and the gravel hills, and of the latter on the stony hills of the Upper Midland District.

The Tulip Tree is not an infrequent component of the topland forest, and also the Beech, although both these species are much more abundant on the soil-covered slopes. Red Maple and Swamp Oak, although occasional in topland forest are most frequent on flood plains, the latter being particularly characteristic of poorly aerated and acid soils here as well as elsewhere in the state.

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A few trees which are quite abundant in open situations sometimes enter into the make-up of the forest, as the Yellow Locust, the Sassafras, the Red Cedar, the Persimmon, the Wild Black Cherry and the Hackberry. The Red Oak and the Shagbark Hickory are infrequent trees, both of which are much more abundant in the Upper Midland District and the Mountain Zone. The stands of pine which occur being young and dense are very poor in shrubby and herbaceous undergrowth. The seedlings of the Black and Scarlet Oaks are common, and the Dogwood, together with the Squawberry and a scattered growth of xerophilous grasses and such composites and leguminous plants as are common in the pine forests of the Coastal Zone make up the total of a vegetation which is in striking contrast with that of the nearby deciduous forests.

The undergrowth in the Loam topland is made up to a great extent of young seedling trees rather than of shrubs,—in strong contrast to the conditions in the Coastal Zone. The Dogwood is the commonest of the shrubs and smaller trees, often being extremely abundant. Other common species are *Viburnum dentatum, Vaccinium stamineum, Gaylussacia resinosa, Viburnum acerifolium, Rhus hirta, Viburnum prunifolium, Vaccinium pennsylvanicum.*

The herbaceous vegetation of the forests on the loams is extremely rich and varied, probably embracing one third of the herbaceous flora of the state. Many species are common and widespread, others are confined to deep shade, others to open forests and still others to rocky soils. Many others are infrequent or rare in no relation to physical conditions. In the same places in the forest there are likewise differences in the aspect of the herbaceous vegetation during the different months of the growing season. In the last week of March and the early part of April the following are in bloom and conspicuous: *Hepatica hepatica, Sanguinaria canadensis, Carex pennsylvanica, Claytonia virginica, Viola labradorica, Juncoides campestre* and *Alsine media.* One or two weeks later follow: *Epigaea repens, Asarum canadense, Syndesmon thalictroides, Carex nigromarginata, Aquilegia canadensis, Potentilla canadensis, Antennaria neo-dioica, Mitella diphylla, Viola blanda* and others. After the last weeks of May there is a period in which relatively few species are

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found in bloom, the spring flora having passed its climax, and the summer and fall species being still in the course of their vegetative activity. The following species are those which are most abundant and characteristic:

Potentilla canadensis
Aster divaricatus
Geum canadense
Galium lanceolatum
Brachyelytrum erectum
Phegopteris hexagonoptera
Vagnera racemosa
Anychia dichotoma
Eragrostis eragrostis
Solidago patula
Alsine pubera
Houstonia purpurea
Hieracium venosum
Alsine media
Oxalis acetosella
Polygala mariana
Meibomia grandiflora
Silene stellata
Viola cucullata
Uvularia perfoliata
Salvia lyrata
Dioscorea villosa
Heuchera americana
Aster puniceus
Porteranthus trifoliatus
Dasystoma laevigata
Chimaphila umbellata
Agrostis perennans
Aster cordifolius
Aster paniculatus
Botrychium virginianum
Pedicularis canadensis

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FIG. 1.—VIEW SHOWING SCRUB PINE AND BLACK JACK OAK ON THE SUSQUEHANNA CLAY, NEAR BOWIE, PRINCE GEORGE'S COUNTY.

FIG. 2.—VIEW SHOWING ROCKY SLOPES WITH PURE STAND OF HEMLOCK ALONG THE PATAPSCO RIVER, NEAR NORTHBRANCH, BALTIMORE COUNTY.

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Zizia cordata
Hydrocotyle americana
Hypopitys hypopitys
Gentiana andrewsii
Cunila origanoides
Gerardia purpurea
Lobelia inflata
Cimicifuga racemosa
Peramium pubescens
Mitchella repens
Cracca virginiana
Corallorhiza corallorhiza
Chimaphila maculata
Pyrola rotundifolia
Aralia nudicaulis
Elymus canadesis
Monotropa uniflora
Solidago flexicaulis
Collinsonia canadensis.

SOIL-COVERED SLOPES.

The Soil-Covered lower Slopes of the mature topography of the Lower Midland District are rich in tree species. It is in this habitat that all of the forms reach their best development,—the Oaks and the Tulip Tree have been seen in several parks and private estates attaining to a height of 125 to 140 feet, a marked contrast to the size reached by the largest trees of the Serpentine Barrens.

The predominant species are the Tulip Tree, the Beech, the Red Maple, the Bitternut Hickory, the White Ash, the Black Walnut and the Black Gum. Trees of the topland, such as the Black Oak, Chestnut and White Oak are by no means absent, but it is only the last which is common. The above-named trees vary in their relative abundance, the Tulip, Beech and White Oak together forming from 40% to 60% of the stand and the others above mentioned varying from 35% to 40%. Other species which are infre-

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quent include the Butternut, the Sweet Birch, the Sugar Maple, the Linden, the Red Oak and the Shagbark Hickory, all of which are much more abundant or even characteristic in the Upper Midland District and the Mountain Zone. The slopes on which these subordinate species are most abundant are those along the larger streams of the district, as Deer Creek, the Gunpowder and the Patapsco. A rare tree found only on the slopes is the Umbrella Tree (*Magnolia tripetala*) the very large leaves of which make it the most striking of the smaller forest trees.

The most frequent and characteristic of the shrubs which are found on the slopes but not on the topland are *Hamamelis virginiana* and *Hydrangea arborescens,* the latter of which is more abundant in the Upper Midland District. Very many of the herbaceous plants found in the deepest shade or in the soils of highest humus content in the topland are also characteristic of the slopes. The most general in occurrence of these are:

Carex stricta
Aquilegia canadensis
Arisaema triphyllum
Asarum canadense
Dryopteris marginalis
Adiantum pedatum
Asclepias quadrifolia
Juncoides campestre
Collinsonia canadensis
Scirpus planifolius
Brachyelytrum erectum
Salvia lyrata
Washingtonia longistylis
Hydrophyllum virginicum
Galium tinctorium
Carex costellata
Mitella diphylla
Solidago flexicaulis.

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ROCKY SLOPES.

The steeper slopes on which the soil is thin or confined to pockets in the rocks bear a markedly different vegetation from the gentler and soil-covered slopes. The trees may be pure stands of Chestnut Oak or stands of Chestnut Oak with a smaller percentage of Chestnut, or again, where the slopes are precipitous, the Scrub Pine may be more abundant than either. On the rocky slopes of the Gunpowder and other large streams the Hemlock is not infrequent, and the White Oak and the Black Oak may be present with these trees. The Juneberry (*Amelanchier canadensis*) is a small tree common on all rocky slopes, and most conspicuous at its flowering time in the last weeks of April. Thickets of *Kalmia latifolia* often cover the slopes which afford sufficient soil, with *Vaccinium stamineum* in less abundance. The herbaceous vegetation is poor in species in comparison with any of the other habitats of the district excepting the gravel, and is indeed similar to that found on the gravel hills. Among the commoner species may be mentioned:

Mitchella repens
Epigaea repens
Deschampsia flexuosa
Polypodium vulgare
Carex pennsylvanica
Peramium pubescens
Heuchera americana
Porteranthus trifoliatus
Solidago rugosa
Chimaphila maculata
Asplenium platyneuron
Antennaria plantaginifolia
Potentilla canadensis
Houstonia coerulea
Solidago concolor.

Outcrops of rock and rocky slopes which are kept constantly moist by the seepage of underground water seem to have been

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the favorite habitat of the Hemlock and the Butternut, as well as a number of herbaceous plants which were doubtless much more common in the virgin forests than they are now, but are still abundant in the Upper Midland District. Among these may be mentioned: *Saxifraga pennsylvanica, Panax trifolium, Hieracium paniculatum, Capnoides sempervirens, Parietaria pennsylvanica, Trautvetteria carolinensis, Asplenium trichomanes, Sedum ternatum.*

FLOOD PLAINS.

The Flood Plain areas of the Lower Midland District are distributed along all of the constant streams, varying in breadth with the size of the stream from a few feet to as much as half a mile at some localities along the Potomac. Their rich alluvial soils maintain a high percentage of moisture and have the ground water level within a few feet of the surface, but the surface layers of the soil are seldom continuously saturated, as is the case with many of the Flood Plains of the Wicomico terrace on the Eastern Shore. The inundation of the Flood Plains is frequent during the spring and summer, but is always of very short duration on all but the largest rivers.

The Flood Plains were all originally heavily wooded with a forest rich in tree species. The Tulip Tree, Red Maple, Swamp Oak, Black Gum and Slippery Elm, and White Elm are the most common forms and together make up 80% of the stand in most of the Flood Plains examined. Other characteristic species are the River Birch, the Hornbeam, the White Ash, the Bitternut Hickory and the Green Ash. The Box Elder is abundant in the Flood Plains about the head of the Elk River and along the Potomac, but has not been noted in the other parts of the Lower Midland District, although it occurs in the Western Shore District of the Coastal Zone. Other infrequent species are the Willow Oak, which only occurs along the Potomac as far as Seneca Creek; the Shingle Oak, which is not infrequent in Montgomery County in the vicinity of Gaithersburg and the Great Falls, but is known elsewhere in the state only from Zekiah Swamp, in Charles County; and the Swamp White Oak, which also occurs in the Upper Midland

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District. The Paw-Paw, the Wahoo, the Bladdernut and the Red Mulberry are infrequent along the Potomac and the Patapsco.

Along the banks of streams the Buttonwood and the White Willow are the most familiar trees. The shrubby willows are particularly abundant along stony shores and on the most low-lying parts of the flood plains of the larger streams; of them the Black Willow is the most common except along the Potomac, where Ward's Willow is equally abundant.

The herbaceous flora of the Flood Plains shows a much closer affinity with that of the moist soil-covered slopes than with the sandy Flood Plains of the gravel soils of the Lower Midland or the Flood Plains of the Coastal Zone. The numerous species, sporadic in their occurrence, comprise characteristically the following:

Spathyema foetida
Homalocenchrus virginicus
Adicea pumila
Thalictrum dioicum
Cardamine purpurea
Chrysosplenium americanum
Rubus hispidus
Deringa canadensis
Chelone glabra
Gratiola virginiana
Ranunculus sceleratus
Onoclea sensibilis
Lobelia puberula
Veronica americana
Carex lupulina
Carex bullata
Viola sagittata
Urticastrum divaricatum
Boehmeria cylindrica
Carex hirta
Cyperus strigosus
Elymus virginicus
Veratrum viride

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Anthoxanthum odoratum
Viola lanceolata
Carex stricta
Calamagrostis cinnoides
Heracleum lanatum
Lobelia cardinalis
Aster puniceus
Carex rosea var. *radiata*
Carex vulpinoidea.

Vegetation of the Cecil Clay.

TOPLAND.

The differences which distinguish the vegetation of the Cecil Clay and that of the Loams are not great as respects the arboreal flora; indeed, in view of the great variability of the forests on the loams due to human agency, it is with hesitation that any but the most general differences observed in the field are held to be significant. As indicated in the Introduction the soils derived from gabbro are peculiar in their chemical character owing to the presence of small amounts of magnesium and the absence of lime, the same features in less degree which characterize the serpentine soils. The peculiarities of the gabbro soil would indicate, however, that the magnesium salts do not exert a toxic effect, as the number of species absent from them is small, and none of the plants show peculiarities of structure or dwarfing of size. The distinctions which may be observed between the gabbro clay and the loams are all readily accounted for by the physical character of the clay. The tree species which are predominant are such as are more abundant in moist and poorly drained soils, the herbaceous species which are absent are those that occur most abundantly in sandy or other light soils. The differences which the Cecil Clay areas present are, then, similar in a close degree to those described for the Elkton Clay on the Eastern Shore.

The Cecil Clay of Harford County bears topland forest in which the Chestnut and Mockernut Hickory stand in about the same relation to the make-up as on the Loams, while the Black Oak is

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less abundant than on the Loams, and the Chestnut Oak and Scarlet Oak are nearly absent. The Tulip Tree, on the other hand, is quite as abundant as on the Soil-covered Slopes of the Loam soils, and the White Oak is only slightly less so. The Swamp Oak is more abundant than on the Loam slopes, and the Black Walnut, Linden and Red Bud are infrequent. The herbaceous species which are rare or absent on the gabbro clay are such as the species of *Meibomia, Lespedeza, Lechea* and *Helianthemum, Mitchella repens, Epigaea repens* and other of the commoner psammophilous plants.

Vegetation of the Serpentine Barrens.

The Serpentine Barrens of the Lower Midland District have been examined at Conowingo in Cecil County, Dublin in Harford County, the Bare Hills and Soldier's Delight in Baltimore County, and near Gaithersburg in Montgomery County. The principal features of the Barrens are extremely uniform in all of the areas, and like the Gravel they are most pronounced in the character of their vegetation on the topland and in the driest situations, for some of the deepest Conowingo clay in Cecil County bears a grouping of forest trees and other vegetation not very unlike that on Loam Slopes. The fact that the serpentine weathers readily cause the rock outcrops to be covered with fragments (See Plate XX, Fig. 2) and the failure in formation of a soil is possibly connected not only with the ready drainage afforded by the topography, but with the chemical character of the rock fragments as well. That the peculiarities of the Serpentine areas are not due solely to the physical conditions is attested by the difference between their vegetation and that of the shale exposures of the Upper Midland District, where the physical conditions are almost identical. That the physical conditions are partly responsible, however, for the peculiarities noted is shown by the normal character of the vegetation of the deep areas of Conowingo clay, where, on the other hand, it is altogether likely that much of the harmful excess of magnesium has been leached out of the soil.

Some of the Barrens are of the same physiognomy as other forests in the Midland Zone, but those in the Soldier's Delight

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area of Baltimore County have an open park-like stand of trees (See Plate XX, Fig. 1). The age of the trees and the absence of seedlings indicates that this is not an early stage in reforestation ultimately giving rise to a more densely closed stand of trees. The Black Jack Oak and the Post Oak are often the sole trees of the thinnest soil, or they may be accompanied by the Red Cedar. The predominance of these two Oaks on the Barrens is one of their most interesting features, for neither of the trees is very common on other soils, although they occur on the sands of the Eastern Shore and on rocky slopes in the Upper Midland District. Infrequent trees on the thinnest soils are the Sassafras, the White Oak and the Black Oak, while near Gaithersburg the Scrub Pine replaces the Cedar. The scattered shrubs are *Vaccinium stamineum, Gaylussacia resinosa, Kalmia latifolia* and *Salix tristis.* The most interesting members of the herbaceous flora are the two species which have not been found off the Serpentine Barrens in the state,—*Talinum teretifolium,* a small plant with a rosette of terete succulent leaves, and *Cerastium arvense,** the stems of which have internodes so shortened that the leaves are imbricate in arrangement.

In other respects the flora of the thin Serpentine soils is like that of other open xerophilous situations. The areas are not sufficiently extensive, nor are the observations which have been made sufficiently full, to give an authoritative list of the species which are absent. Among those which are characteristic of the Barrens are:

Andropogon virginicus
Lechea minor
Danthonia sericea
Cerastium arvense
Helianthemum majus
Hieracium scabrum
Aster ericoides
Polygala verticillata
Potentilla canadensis

*In Maryland *Cerastium arvense* is confined to the Serpentine Barrens while *Cerastium arvense* var. *oblongifolium* is ubiquitous, the reverse relation to that commonly reported.

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FIG. 1 —VIEW SHOWING SERPENTINE BARREN WITH BLACK JACK AND POST OAK, SOLDIER'S DELIGHT, BALTIMORE COUNTY.

FIG. 2.—VIEW SHOWING THE THIN SOIL COVERING ON THE TOPLAND OF THE SERPENTINE BARRENS WITH FLOWERING CLUMPS OF FIELD CHICKWEED, SOLDIER'S DELIGHT, BALTIMORE COUNTY.

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Panicum depauperatum
Linum medium
Antennaria plantaginifolia
Solidago virgata
Veronica officinalis
Kneiffia fruticosa
Houstonia coerulea
Senecio balsamitae
Talinum teretifolium.

The contrast between the thin Serpentine soils just described and the deeper Conowingo clay has been noted near Conowingo, Cecil County. At a locality where a cut in the county road shows the soil to have a depth of five feet, there is a forest stand made up of Chestnut, Black Oak and White Oak, together forming 80% of the stand, in which the Black Jack and Post Oaks fall in abundance so as to make together only 5% of the total. The Pignut Hickory, the Sassafras and the Black Gum are present in small numbers. Not only the arboreal but the shrubby and herbaceous floras as well here partake of the character of Loam topland.

Vegetation of the Susquehanna Gravel.

The Gravel soils of the type which has been designated as Susquehanna gravel by the Soil Survey, are deposits mainly of Cretaceous but partly of Pleistocene age, which are sometimes of considerable depth. They are irregularly distributed along the southeastern edge of the Lower Midland District, occurring in a belt of country about ten miles in width just within the "Fall-line." The farthest areas from the "Fall-line" are shallow deposits overlying granite and gneiss and are confined to the topland or level hilltops. Nearer the "Fall-line" more extensive areas occur, which are more varied in their topography, comprising abrupt isolated hills, such as Foy's Hill and Egg Hill in Cecil County, as well as level areas and ravine bottoms. The topography is much younger and more irregular than that in the Piedmont Plateau proper. The Neck lying between the Elk and North-East rivers, while technically a

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part of the Coastal Plain, belongs to this series of "Fall-line" Gravel hills, and is identical with them in its vegetation.

On the summits and higher slopes of the isolated hills in the Gravel region the vegetation is almost as marked in character as on the Serpentine Barrens. On the lower slopes and in the ravines these features are largely obliterated by an approach to the flora and groupings of the Loam areas of the Coastal Zone. In the ravine bottoms the sandy elements of the gravel often form considerable deposits and some of the plants characteristic of the sandy swamps of the Eastern Shore may sometimes be found.

The typical Gravel forest is made up of Chestnut and Chestnut Oak, regardless of the age or stage of reforestation. The two are usually pretty equally represented and together form from 60% to 90% of the stand. On the summits of hills and well-drained slopes the percentage is higher, on lower slopes and in level areas it is lower. The commonest associated trees in the drier situations are the Black Jack Oak, the Scarlet Oak, the Black Oak and the Red Maple. The Scrub Pine occurs sporadically in groves or small groups, and the Pitch Pine has been observed in a few places, where it has reseeded abandoned areas.

There have been very few attempts to cultivate any part of the Gravel areas of Cecil and Harford counties. There has been a continuous cutting of the small timber for use in making charcoal, which has prevented any improvement of the physical condition of the soil through the return of a mature forest stand. The extensive "Barrens" of Cecil County are traversed by the main line of the Pennsylvania Railroad, which indeed follows the course of the Cretaceous gravels and clays from Elkton to Washington, thereby presenting to the traveler the least promising and least improved section of the state.

The Laurel (*Kalmia latifolia*) forms continuous thickets in many of the Gravel forests and is in all places the predominant shrub. On the summit of Egg Hill, in Cecil County, occurs the Rhododendron (*Rhododendron maximum*), which is not known from any other station in the state east of the Blue Ridge. The occurrence of this shrub here in a situation in which the soil conditions are so radically different from those of its usual habitat is a striking

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exception to the conditions usually governing the occurrence of plants outside their normal range. Other shrubs characteristic in the drier Gravel forests are *Vaccinium stamineum, Vaccinium pennsylvanicum, Gaylussacia resinosa, Salix tristis* and *Castanea pumila,* while in the lower and moister forests there is a richer assemblage of the forms found in the Loam forests of the Coastal Plain, including *Clethra alnifolia,* here at the limit of its range, *Vaccinium corymbosum, Pieris mariana,* also at the limit of its range, *Xolisma ligustrina, Azalea nudiflora, Viburnum acerifolium* and *Viburnum dentatum.* In the saturated gravel about the bases of the hills *Hamamelis virginiana* is not infrequent.

The herbaceous species which characterize the Gravel hills are of a xerophilous character, and the same forms not only occur throughout the Chestnut-Chestnut Oak forest in this District, but in the Ridge forest of the Mountain Zone and on gravel hills of morainic origin in neighboring states to the north. The commonest species are:

Melampyrum lineare
Cunila origanoides
Dasystoma pedicularia
Andropogon virginicus
Baptisia tinctoria
Nabalus albus
Lacinaria graminifolia var. *pilosa*
Chrysopsis mariana
Mitchella repens
Linum medium
Lobelia inflata
Hieracium scabrum
Angelica villosa
Lechea minor
Euphorbia corollata
Gerardia purpurea
Polygala nuttallii
Kneiffia fruticosa
Smilax rotundifolia.

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Conclusions.

The Lower Midland District is geologically old, which is to say that it has undergone but little recent change of elevation due to crustal movements, and has been altered in its surface features only by the prolonged erosion to which it has been subjected. The soil conditions were doubtless somewhat similar to those of the present day throughout Mesozoic time, excepting for the more recent Cretaceous and Pleistocene deposits which constitute the Gravel soils of the "Fall-line" border of the District. The climatic conditions underwent profound oscillations during late Pliocene and early Pleistocene time, owing to the successive epochs of glaciation to the northward, and this gave occasion for the northward migration of southern forms alternately with the pushing southward of northern forms. We thus see that while the topographic conditions governing the local distribution of vegetation have been only slowly changing through long periods of geological time the character of the flora has been changed several times in a fashion which has resulted in an admixture of northern and southern species. The more recent Coastal Plain has been seen to have been a highway along which southern species have migrated northward. Very many of these have not spread beyond the "Fall-line," apparently on account of unsuitable soil conditions, a few others show by their abundance on the Coastal Plain and their occurrence in favorable habitats on the Lower Midland District that they are migrating into this District from the favorable highway.

The fact of the dependence of the nature and distribution of vegetation upon the character of the topography causes a young and diversified topography to present a greater differentiation of vegetation than does a mature one. We have such a difference well exemplified in the Coastal Zone, where both Upland and shore-line changes are going on with relative rapidity, and in the Lower Midland, where the topography is well matured. In theory the climax of topographic development is the reaching of base level, but in so far as vegetation is concerned, the reaching of maturity is a climax which is so nearly stable as to present uniform conditions

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over a period of time in which crustal movements or climatic changes may have opportunity to offset the influence of topography.

In the entire Midland District the topland presents differences of vegetation which are due to the character of the underlying rock. These differences were doubtless more pronounced in younger states of the topography than they are now, but they are such that they will always manifest themselves even if the region were to undergo complete planation.

The Topland vegetation of a particular soil type is that which must be looked upon as the climax, for it is the type which has resulted from the maturing of the topography. The Rocky Slopes are but a trifling percentage of the total area of the District, and are due to secondary lateral cutting by the larger streams, i. e., a feature due to a regression in the topographic development of the District. The Rocky Slopes, however, are destined to pass through the Soil-covered Slope stage ultimately to that of the Topland. The Flood Plains are likewise destined to silt up until their vegetation approaches in character that of the Topland.

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ECOLOGICAL PLANT GEOGRAPHY OF MARYLAND, MIDLAND ZONE; UPPER MIDLAND DISTRICT

BY

FREDERICK H. BLODGETT

Introductory.

The Upper Midland District may be regarded as consisting of four natural belts crossing the state from north to south. Three of these belts are hilly or mountainous, these are the Parr's Ridge belt, the Blue Ridge, including Catoctin Mountain, and the group of ridges westward from North Mountain. The fourth belt lies partly between the first and second of those named but mainly between the Blue Ridge and North Mountain. The parts of this belt are the valleys of the Monocacy and of the Antietam Creek respectively. To the west of North Mountain there are no wide valleys of the same character as these, those present being narrow with steep sides sloping to the stream bed at the bottom.

Parr's Ridge Area.

The Parr's Ridge area consists of a series of ridges of moderate height, approximately parallel to the axis of the main elevation, which lies to the west of the central line of the area. The relation of the several elements of the topography may best be seen near the town of Westminster, as the main ridge is there well developed and the subordinate ones distinct on account of the valleys of the streams which lie between them. The narrow valley of Little Pipe Creek, about a mile west of the town, cuts through the main axis of Parr's Ridge and broadens on each side into wide valleys. The streams at this point are tributary to the Monocacy River through the Pipe Creek valley.

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The soils of the Parr's Ridge area are largely of the igneous series and develop good farm land where suitably located. The natural cover of the region was a mixed deciduous forest, which is still present on the higher ground, and less conveniently situated parts of the ridge. The deeper soils are covered with the typical climax forest, of Oaks, Maple and a large percentage of Beech, accompanied by the herbaceous plants which are common to soils rich in humus and by the woody plants which find the same conditions favorable to their development. There are a few outcrops of limestone, but the extent of these is not sufficient to make a difference in the vegetation of the area.

Hills.—The Chestnut is the predominating tree of the rich hillsides, with the Chestnut Oak the next in order of abundance. These two trees are associated also on the stone or boulder-strewn slopes, if there is opportunity in the spaces between the rocks for the accumulation of leaves and of other refuse of the forest to produce the humus in which the tree reaches its best development. In those cases in which the soil is comparatively free from rocks, the humus is often several inches deep, and gives the conditions suited to the development of the species of Hickory (*Hicoria alba, Hicoria glabra*) and of Beech. As undershrubs grow the Huckleberries (*Gaylussacia frondosa, Gaylussacia resinosa*) the Blueberry with the Laurel and Arbutus, while amid thick clumps of decaying leaves grows *Monotropa uniflora.*

Considering the more open and dry spots in such a forest area, the margins of the opening have *Baptisia tinctoria* as one of the conspicuous plants. This is also a roadside annual, being found along the roads in woodland regions with slight choice as to the character of the soil, but reaching its best development upon the sandy or well drained soils of hillsides. It and *Pteris aquilina* are conspicuous features of the burned-over areas.

In the more moist locations the Red Maple (*Acer rubrum*), the Black Gum (*Nyssa sylvatica*) together with *Spathyema foetida, Osmunda cinnamomea* and *Osmunda claytoniana* are found in association. About the margins of such moist areas the orchids are to be expected and in this vicinity *Orchis spectabilis, Pogonia verticilata* and *Peramium pubescens* are seen in the region of shade

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FIG. 1.—VIEW SHOWING EDGE OF FOREST IN THE SERPENTINE BARRENS WITH BLACK JACK OAK, POST OAK AND SCRUB PINE, NEAR GAITHERSBURG, MONTGOMERY COUNTY.

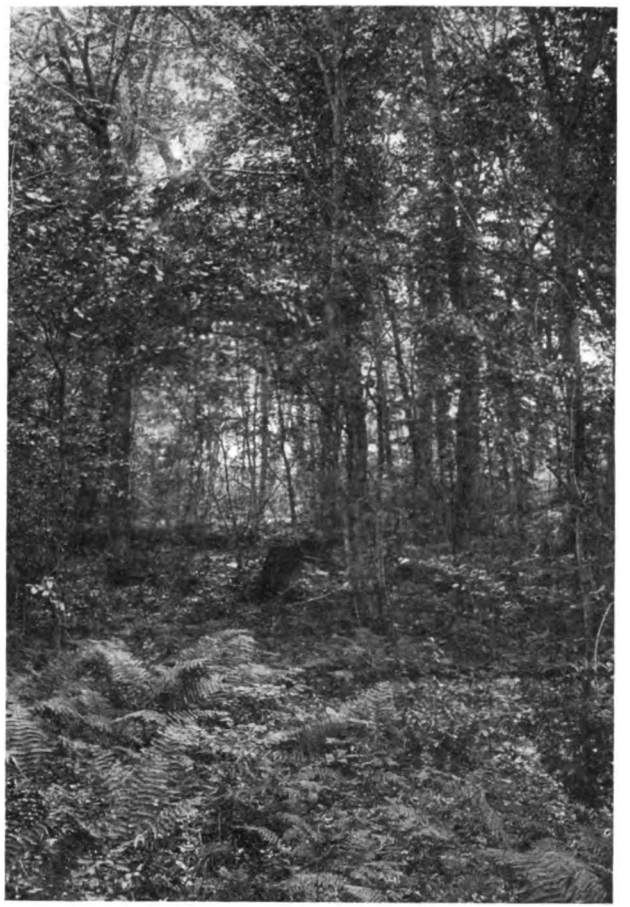

FIG. 2.—VIEW SHOWING LOW UNDERGROWTH WITH FERNS CHARACTERISTIC OF MOIST HUMUS SOILS IN THE UPPER MIDLAND DISTRICT, NEAR HANCOCK, WASHINGTON COUNTY.

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and moist humus. Of the fern species *Onoclea sensibilis* is found in the open moist places, extending into the open meadow areas. *Dicksonia punctilobula* is found in the places in the forest where shade is moderate and moisture and humus conditions favorable. In the drier localities *Dryopteris marginalis* and *Dryopteris acrostichoides* are common, and in spots still less moist, like the outcropping rocks, *Polypodium vulgare* occurs.

The general conditions of soil moisture and humus content are not quite so favorable as obtain farther from the Pennsylvania line and away from the deeper valleys of the district just discussed. An intermediate series of habitats occurs in the vicinity of the Little Pipe Creek cut through Parr's Ridge. The most noticeable single variation is the difference in the abundance of the Tulip Tree, which here forms about 20% of the forest cover, while it is inconspicuous or scarce in the region to the north of Westminster.

The Oaks constitute the major portion of the woodland growth and include the Chestnut Oak, the White Oak, the Black Oak, and have as associated trees the Mockernut Hickory, the Butternut, and the Chestnut. The smaller woody plants here include the Dogwood in considerable abundance, Witch Hazel and Spice-bush. A hillside covered with this type of forest is shown in Plate XXII, Fig. 1. The herbaceous plants are not greatly different from those noted on the northern slope, but such plants as *Orchis spectabilis* there found in some frequency are rare or absent here. Other plants of the deep forest which were observed at this locality are:

Polygonatum biflorum
Arisaema triphyllum
Vagnera racemosa
Uvularia perfoliata
Sanguinaria canadensis
Hepatica hepatica
Aralia nudicaulis
Porteranthus trifoliatus
Urticastrum divaricatum
Cubelium concolor.

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Roadsides.—In the Upper Midland District one of the most abundant plants of the roadside, margins of woods and similar habitats, is *Anemone virginiana.* Along the roads in open locations are *Lactuca scariola, Medicago lupulina, Specularia perfoliata* and *Cimicifuga racemosa.* Upon the elevated banks along the roads the Chinquapin is a rather frequent shrub and the Locust tree is common. The latter seems to have a great tolerance for lime in the soils that it occupies, for it has been seen in a number of instances growing within the burn-pit of abandoned lime-kilns. The Sumac (*Rhus copallina*) is frequent, as are also *Eupatorium perfoliatum, Eupatorium purpureum* and *Euphorbia corollata.*

The actual proportion of Chestnut present in the forest of these slopes is probably not less than half, for the trees in flower seem to cover nearly two-thirds of the visible canopy, but as they then hide the less conspicuous trees, the former proportion is the more likely. This refers of course only to trees of full size.

Valleys.—In the deeper valleys of the streams which drain the rolling ground, there are frequently small areas of swampy land, some of these are due to natural conditions, while others are artificial in origin. In either case the floral conditions are quite similar, and while the succession of forms may be quite different, the species present are likely to be very much the same in swampy areas of any considerable age. In a swamp at the head of a small mill pond south of Westminster, the following plants were noted:

Orontium aquaticum
Sagittaria latifolia
Sparganium androcladum
Alisma plantago-aquatica
Campanula americana
Hydrocotyle americana
Impatiens biflora
Selaginella apus
Sphagnum sp.
Osmunda cinnamomea
Eupatorium perfoliatum
Potomageton nuttallii
Alnus rugosa
Polygonum sagittatum.

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The ground slopes rapidly from the low area, and in a short distance becomes so dry that the Bear Oak and the Chinquapin find suitable habitats, and other species of oak, such as the White Oak, the Swamp Oak, Post Oak, the Black Oak and the Chestnut Oak also grow close to the wet ground, but on the drier hillside. The only specimen of the Scrub-Chestnut Oak (*Quercus prinoides*) seen in this section of the state was found along the road at the top of the slope of the valley where this swamp was located. The conditions were very dry, the habitat was fully exposed to the south winds and full sun; being the elevated bank of a sandy and rocky road.

To the east of the Ridge, the same series of lower ridges or long hills occur, and among them are similar localities with moist soil in which the plant growth is slightly different from that of the areas already mentioned. *Osmunda regalis* is among the plants not previously noted, and the presence of the Elder (*Sambucus canadensis*) is a conspicuous feature of the low ground vegetation. *Thalictrum dioicum* is in good bloom in early July, and *Sericocarpus linifolius* is also in flower. One of the species of Milkweed, *Asclepias pulchra,* is common in the moist situations, and in the thickets the two Haws (*Viburnum dentatum* and *Viburnum prunifolium*) are associated with the Choke-berry (*Aronia arbutifolia*). Under the branches of the thicket shrubs *Spathyema foetida* and *Orontium aquaticum* are occasional, and in the more exposed spots with abundant moisture, *Aletris farinosa, Sagittaria latifolia, Rhexia mariana,* and *Polygala viridescens* occur.

The sides of the ridges are often steep and therefore well drained or even very dry especially if there has been recent cutting of timber. The conditions then are extremely hard upon vegetation, since fire follows in so large a number of instances that it seems almost the usual sequence.

Under the unfavorable conditions of sudden increase of strong sunlight, greater circulation of drying winds, and the severe mechanical injury due to careless felling of the trees, only the most hardy of the original plants can survive, and these have to combat under a disadvantage, the hardy invaders from roadsides, or other waste places, where the conditions are even more severe.

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Cut Over Areas.—Under these changes of environment, the plants which become conspicuous are *Baptisia tinctoria, Pteris aquilina* and species of *Solidago;* the tall composites such as *Eupatorium purpureum,* and *Vernonia noveboracensis.* In areas which have been cut over at some time more remote, but which have not been able to reestablish the former conditions of wooded slopes, the Bear Oak and the Chinquapin are to be expected, and are commonly found together with *Comptonia peregrina* in full sunlight exposures. *Lespedeza hirta* often occurs with these, and also the white-flowered *Euphorbia corollata.* There is often a low growth of prostrate or trailing plants in places not too greatly exposed to the heat and dryness, and in these places *Veronica officinalis, Dasystoma virginica* and *Dasystoma pedicularia* are to be expected. Mosses and lichens abound in these localities, but they are of the cosmopolitan forms in all instances where the species were noted. *Dioscorea villosa* occurs commonly in open woodland, either in fairly moist, or in quite dry situations, and *Cimicifuga racemosa* is found in a similar variety of habitats. In certain localities along the roadside, the Beaked Hazel forms the roadside shrubbery, and less frequently in this vicinity, it is supplanted by the common Hazelnut. Where there is a small stream in woodland situations, the Witch Hazel and the Spice-bush are usually present. *Cassia nictitans,* and *Cassia chamaechrista* occur at frequent intervals in the taller vegetation of the dryer situations.

Drainage.—The high ground of Parr's Ridge extends toward the southwest, gradually decreasing in elevation, but there is an increase in the number of subordinate ridges in the vicinity of Mount Airy, beyond which point the central ridge becomes lost as an axial elevation. Numerous low hills replace the ridges of the more northern parts, and the intervening valleys are correspondingly less deeply cut, and the sides are less steep. Between the Little Pipe Creek region which has just been discussed, and the vicinity of Mount Airy, the streams belong to two drainage systems; the area is in the nature of a divide, with the Patapsco drainage on the east and the Monocacy on the west through the wearing down of the elevated land into subordinate hills. The two systems approach in the vicinity of Mount Airy.

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The vegetation along the divide does not materially differ from that in similar situations already described, except as shown by the increase in abundance of Red Cedar or Hickory and Scrub Pine. The Pitch Pine is seen occasionally and the Bear Oak and Chinquapin are common along the roadside. *Kalmia latifolia* and *Epigea repens* were absent along the ridge from Westminster to Mount Airy in places apparently suited to their growth.

In the immediate neighborhood of Mount Airy, the following plants were noted, some of which have not been recorded along the upper portions of the Ridge region:

Diospyros virginiana
Quercus platanoides
Lobelia inflata
Gaylusaccia frondosa
Acer saccharinum
Agastache scrophulariaefolia
Xolisma ligustrina
Alnus rugosa
Polygala verticillata
Cunila origanoides
Mesadenia atriplicifolia
Prunella vulgaris.

In habitats which were more moist the following species were recorded:

Fraxinus americana
Kalmia latifolia
Acer saccharum
Liriodendron tulipifera
Lobelia cardinalis
Melilotus alba
Quercus velutina
Platanus occidentalis
Epigaea repens
Acer rubrum
Carpinus caroliniana

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Lobelia syphilitica
Verbesina alternifolia
Quercus acuminata.

The soil in the hills into which the Ridge becomes divided is favorable for farming operations, and is more extensively used for this purpose than is the more rugged, steeper region to the north of this point. For this reason there is less of natural vegetation to be noted, except as such may take the form of roadside weeds, or meadow plants. The influence of the hauling of farm produce appears in the distribution of some of the more conspicuous weeds of the fence corners and roads. *Dipsacus sylvestris* is so distributed in some abundance along the main lines of turnpike travel, and is to be found westward from Mount Airy scattered throughout the Midland zone in very similar localities. *Lactuca scariola* is another plant which follows the path of the farmer, and to a more serious degree *Plantago rugelli* and *Plantago lanceolata* which do damage as weeds infesting clover fields. These are especially troublesome after the fields have stood several years without plowing, as in wheat-clover-timothy years of the farm rotation.

The waste places abound in species of *Solidago* and *Aster*. Along the roads, *Trichostema dichotoma* and *Bidens bipinnata* occur. The Black Locust is a common tree along the fence lines, from the immediate vicinity of Mount Airy along the pike toward Frederick, and indeed through the entire region of agricultural activity. This is partly due to the custom of using the living trees as posts in the fence line, and the accompanying economy of space for tree growth, and partly to the difficulty of keeping the margins of the fields in clean cultivation. The Locust, largely self-sown, occupies otherwise unoccupied ground, and at the same time serves as part of the necessary fencing, and also provides material for later service in the form of cut posts.

Upper Monocacy Valley.

A difference in the general view of the region in the vicinity of the National Pike, and the region to the north, near the Western Maryland Railroad, is due to the absence in the former of the

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frequent woodlots of a few acres extent, that afford the owners the needed fuel, and are a source of some revenue in the sale of nuts. These patches of woodland are of frequent occurrence in the upper part of the region in question, and consist to a large degree of nut trees, together with several species of oak, and an occasional beech, although often too dry and thin soiled for the normal development of the latter tree. In those woodland areas the forest floor is usually covered by a grassy growth of species of *Poa, Muhlenbergia,* and *Panicum,* with such plants of similar habitat as *Viola pedata* and *Carex platyphylla.* Under favorable conditions of moisture and shade there are often large patches of ferns, of nearly pure stands of single species, but these are not so frequent as is the case in the more damp, and heavier humus soil region in the section farther west. The fern which occurs in most abundance in the majority of cases is *Dicksonia punctilobula,* and in a smaller number of cases, *Dryopteris noveboracensis.* In the open wet meadows other ferns take the place of these species, but no rarities or unusual forms were discovered in this type of habitat.

The Sour Gum, which is so common a member of the woodland vegetation in the Lower Zone of the State, is not common here, but occurs occasionally, and often in the same locality with the Tulip Poplar, though not in the majority of cases. Along the edges of the woods, *Stylosanthes biflora* is frequent, with *Cassia nictitans, Meibomia nudiflora,* and *Dasystoma laevigata* just within the border, and scattered through the more open places.

Bottoms.—In the shady moist ground along the bottom lands such plants as the *Erythronium americanum, Claytonia virginica, Podophyllum peltatum,* and *Spathyema foetida* are found in association with the Red Maple, Moose wood, and the Hornbeam in the lower parts of the adjacent woods, and the Red Bud and Dogwood on the slopes of the hillsides. In the deep soil of these woods, where there is considerable light, *Bicuculla cucullaria* forms considerable patches, and *Hepatica hepatica* is common. *Medeola virginiana, Arisaema triphyllum,* and *Trillium cernuum* are to be found in the deeper woods.

The Chicken Grape (*Vitis cordifolia*) is a frequent vine of the forest margin in damp locations, especially in the region between

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the railroad and the State line. Near Silver Run a few Elms were noted, and an occasional Buttonwood; the Hazelnut was present in some abundance in the roadside thickets, and the Choke Cherry (*Prunus serotina*) in the edges of the drier woods, or more open thickets. Among other trees and woody plants seen in the same vicinity the following may be noted:

Quercus macrocarpa
Sassafras sassafras
Nyssa biflora
Hicoria ovata
Gleditsia triacanthos
Quercus palustris
Quercus coccinia
Quercus prinus
Quercus velutina
Quercus alba.

In the list of herbaceous plants of the same region there are to be noted the following species:

Ludwigia alternifolia
Onagra biennis
Oxalis stricta
Lespedeza procumbens
Plantago rugelii
Anthemis cotula
Solidago lanceolata
Saponaria officinalis
Abutilon abutilon
Bidens bipinnata
Cichorium intybus
Meibomia nudiflora
Trichostema dichotomum
Medicago lupulina
Apocynum cannabinum
Datura stramonium
Solanum nigrum
Lechea villosa.

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FIG. 1.—VIEW SHOWING FOREST TYPICAL OF RICH SLOPES WITH OAK, TULIP TREE, YELLOW LOCUST, WHITE PINE, BLACK GUM AND HORNBEAM, NEAR CLEAR SPRING, WASHINGTON COUNTY.

FIG. 2.—VIEW SHOWING MOIST FOREST WITH UNDERGROWTH OF SMILAX, OSMUNDA, HABENARIA AND POGONIA, NEAR WOLFSVILLE, FREDERICK COUNTY.

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The plains which occur in the region a little further to the west, as in the neighborhood of Emmitsburg do not differ to any conspicuous degree until one reaches the wooded slopes of the hills. The more level ground has been cultivated for a long period, and the common weeds are abundant: the woods have been culled in a series of commercial cuttings, taking at one time the merchantable trees of Hickory, White Oak, or Black Walnut, and at a later time removing such of the remaining species as may seem to the owner to be most marketable. In consequence the woodlots are not at all uniform in species, in those localities which are easily reached by roads or saw mills. In the more remote places there is a greater uniformity in the forest stand, but the commercial interests of the individual owner have had a considerable influence even in these cases which can not be estimated in the study of the present stand, except to a slight degree by making a large series of comparisons of separate wooded areas. This has not been practicable, and the species present have been recorded with no attempt to allow for the influence of wood cutting.

Woodlots—The groves, or isolated woodlots upon the separate farms, do not differ materially from the similar pieces of woodland which were described just above, being composed chiefly of Oaks and Chestnut with a scattering of Hickory. As the higher ground is approached in the lower slopes of the Blue Ridge, a more marked difference becomes apparent, and the character of the forest stand becomes quite changed from the type about the Westminster section of Parr's Ridge.

Emmitsburg lies at the northern end of the Frederick Valley and is surrounded by farm lands, which extend furthest on the eastern and northern sides. On the west the farming land is less broad because of the near approach of the Blue Ridge and its foot hills.

Blue Ridge Area.

The Blue Ridge area, like Parr's Ridge, consists of a central axis of considerable elevation with flanking ridges of lesser height more or less parallel with the main ridge. These are dissected into rounded hills by the water courses draining the area. In detail

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The plants which occur in the region a little further to the west, as in the neighborhood of Emmittsburg do not differ to any conspicuous degree until one reaches the wooded slopes of the hills. The more level ground has been cultivated for a long period, and the common weeds are abundant; the woods have been culled in a series of commercial cuttings, taking at one time the merchantable trees of Hickory, White Oak, or Black Walnut, and at a later time removing such of the remaining species as may seem to the owner to be most marketable. In consequence the woodlots are not at all uniform in species, in those localities which are easily reached by roads or saw mills. In the more remote places there is a greater uniformity in the forest stand, but the commercial interests of the individual owner have had a considerable influence even in these cases which can not be estimated in the study of the present stand, except to a slight degree by making a large series of comparisons of separate wooded areas. This has not been practicable, and the species present have been recorded with no attempt to allow for the influence of wood cutting.

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Blue Ridge Area.

The Blue Ridge area, like Parr's Ridge, consists of a central axis of considerable elevation with flanking ridges of lesser height more or less parallel with the main ridge. These are dissected into rounded hills by the water courses draining the area. In detail

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these often show valleys of considerable steepness and have a different type of forest and herbaceous covering from the more gentle slopes. The top of the main ridge, or of the two arms into which it divides southward, consists of massive sandstone and forms a plateau. Here the conditions are quite different from the lower portions.

THE GENTLER SLOPES.

The number of Beech trees in the forest composition increases as the better forest conditions of the hills is reached, and the proportion of the White Walnut or Butternut is considerably greater than eastward. The Hemlock now becomes a prominent feature of the forest landscape, and in places composes nearly or quite one-fourth of the standing timber. Some of the finest specimens of this tree occur in deep narrow valleys of the mountain brooks, but even these are being cut down in many cases. If too inaccessible for heavy teams to remove the logs for timber, the bark is stripped and the log allowed to lie unused in the woods. The Butternut is also rapidly being thinned out of the areas where it occurs, since trees as small as six inches in diameter are now felled for the excelsior factories. The Ash is another tree which is in somewhat greater abundance than previously noted, but does not form a large proportion of the stand at any point observed.

The White Pine is present in the hilly woods to a slight per cent., and occasional Red Cedars occur along the roads. In the moist soil by the side of the streams, the Sweet Birch occurs in some abundance; on the slopes of the streams now the Basswood, Sugar Maple, Mulberry and, on the higher portions, the Beaked Hazel is found. Other plants which occur in the region about Sabillasville, which have not been mentioned in the discussion, are:

Dioscorea villosa
Vagnera racemosa
Uvularia sessilifolia
Monarda fistulosa
Habenaria clavata
Smilax rotundifolia

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Unifolium canadense
Spathyema foetida
Habenaria ciliaris
Lobelia syphilitica.

Among the fern species observed were such common ones as *Polypodium vulgare, Adiantum pedatum, Dryopteris marginalis, Dryopteris achrostichoides, Asplenium platyneuron, Osmunda regalis, Osmunda cinnamomea, Osmunda claytonia; Phegopteris phegopteris, Onaclea sensibilis,* and *Botrychium virginianum;* less frequent were *Woodsia obtusa,* and *Dryopteris cristata.*

The herbaceous vegetation includes the following species:

Echium vulgare
Hypericum densiflorum
Medeola virginiana.
Eupatorium perfoliatum
Medicago lupulina
Lespedeza hirta
Parsonsia petiolata
Phytolacca decandra
Cimcifuga racemosa
Porteranthus trifoliatus.

THE STEEPER SLOPES.

Thurmont.—Thurmont is situated in close proximity to the steeper hills of the Ridge region, and there the streams have cut valleys that are steep-sided and rugged in many cases, affording dense shade in the bottom, with usually a considerable degree of moisture, both from the actual stream water, and from the tendency of the damp air or foggy atmosphere to follow these drainage courses in their movements to or from different levels. The presence of the Showy Raspberry (*Rubus odoratus*) is here noted for the first time in going west, in the deep soil accumulated among rocks, on the slopes of ravines or along roads, where the light is stronger than in the deep woods. The Black Haw (*Viburnum acerifolium*) is found in these along with the Purple species

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(*Viburnum prunifolium*). Other woody plants or trees are *Hydrangea arborescens, Ribes cynosbati, Asimina triloba, Carpinus caroliniana, Juglans nigra* and *Juglans cinerea,* in somewhat larger numbers than at previous places of record, and *Acer nigrum* is recorded for the first time in this area.

It will be convenient in following the geography of the region, to pass southward along Catoctin Mountain as it divides from the Blue Ridge proper. The upper portions of the mountain are formed of resistant sandstone and the resulting soil is of a poor character, supporting a typical xerophytic vegetation, the slopes from the crest to the east are often steep and rugged, the top being to a large degree level.

The characteristic vegetation of the Mountain includes a large proportion of the Bear Oak, Laurel and Sweet Fern. With these in less conspicuous abundance are the following:

Baptisia tinctoria
Dasystoma pedicularia
Lespedeza striata
Pteris aquilina
Gaylussacia frondosa
Potentilla monspeliensis
Solidago bicolor
Lobelia inflata
Solidago juncea
Epigea repens
Dioscorea villosa
Cracca virginiana
Apocynum androsaemifolium.

In hollows where water accumulates, or some spring reaches the surface, there are small patches of *Sphagnum,* and associated plants. In one such spot *Limodorum tuberosum* was found, entirely removed from what normally constitutes its habitat; but the decomposed sandstone, with the pocket of moist sphagnum made the contrast between a low-ground sandy bog and the present spot less striking than appears at first.

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Catoctin.—On the eastern slope of the Catoctin, near Catoctin Furnace, there are the same type of deep ravines, and narrow stream valleys that were noted at Thurmont. The vegetation is quite similar, Hemlock, Beech and Chestnut being the predominating trees in typical localities, and the following occurring in the deeper soil about the heads of the small streams:

Osmunda claytonia
Porteranthus trifoliatus
Mitchella repens
Cypripedium acaule
Chelone glabra
Gaylusaccia frondosa
Rubus odoratus
Rubus occidentalis
Chionanthus virginica
Populus grandidentata
Aralia nudicaulis
Unifolium canadense
Habenaria clavellata
Habenaria lacera
Gaultheria procumbens
Gaylusaccia resinosa
Cimicifuga racemosa
Betula lenta
Nyssa biflora
Hydrangea arborescens.

The crest of the Mountain divides into lesser ridges, one of which runs from the axial line southeastward toward Frederick, affording means of ascent for the road to Smithsburg. Upon the lower slopes of this ridge the greater abundance of Tulip trees and Chestnuts is noted. Beech, Paw-paw and additional species of Oaks, which include beside *Quercus alba* and *Quercus rubra,* both *Quercus coccinea* and *Quercus velutina.* In the small streams at the side of the road, *Callitriche heterophylla* occurs in some abundance. The slopes of the hill become gradually more dry as the flat summit is reached, but the conditions remain fair well toward

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the top, except where fire has aided the dry sandstone soil in producing an arid type of covering. The higher slopes have been subject to forest fires at repeated intervals, and most of the stands of timber are marred by the fire-killed trees in various degrees of decay.

A natural passage-way over the main ridge is found at Braddock Heights and the forest in that region is slightly different from those areas previously mentioned. The following species were noted in the fresh cover at this point: *Quercus macrocarpa, Celtis occidentalis, Acer rubrum, Diospyros virginica,* and for the first time in the mountain area *Quercus marylandica.* The elevation of the mountain at this point begins to diminish quite rapidly, and near Jefferson has become very much reduced, allowing the plants from the lower ground to come into the area of the Catoctin ridges. The Elm appears to be a tree of this character, being found so far along the high grounds only where they are rapidly merging into the more level areas.

Point of Rocks.—Catoctin Mountain is cut through at Point of Rocks by the Potomac River, practically terminating there, although it continues into Virginia as a hill with decreasing elevation. At Point of Rocks, the igneous rocks are exposed, and constitute the "bastard granite" at that point. The rocks above the canal near the tunnel have clumps of *Woodsia obtusa, Aquilegia canadensis, Heuchera americana* and *Saxifraga virginiensis,* and at the base *Vincetoxicum hirsutum* is occasional. Upon the top of the tunnel hill the following species were noted:

Ulmus americana
Ulmus fulva
Cornus florida
Quercus rubra
Robinia pseudaccacia
Pinus virginiana
Quercus alba
Quercus velutina
Cercis canadensis.

and many of the plants already mentioned in the discussion.

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Sugar Loaf Mountain.—This is an isolated portion of the same general elevated land surface as that forming Catoctin, and is situated several miles eastward from Point of Rocks, and slopes on all sides to the general surface of the cultivated region of the Monocacy Valley. The upper portions, as in Catoctin Mountain, are composed of sandstone, and the debris from the higher parts have become distributed over much of the slope, resulting in a considerable amount of sandy soil. The soils at the base, and in the vicinity of Sugar Loaf are of the decomposed igneous type, and form compact loams or clay-loam soils, which support a heavy growth of herbaceous and woody plants.

Along the northern base of the Mountain a small stream, Thurston Creek, flows westward into the Monocacy, and its banks are covered to a large extent with good forest. Small areas of floodplain soils along the course of the Creek or at points where its side branches join the main stream, afford habitats for the growth of plants requiring deep, moist soil, with much shade. In such places the usual grouping of *Benzoin, Hamamelis, Viburnum acerifolium, Fraxinus, Carpinus, Cercis, Fagus* and *Cornus* occurs, while species of *Salix* occupy the more boggy places of poor drainage along the stream. The Box Elder was here recorded, associated with the Buttonwood, the Elm and the Sweet Birch; an occasional Hemlock, and a considerable abundance of the Tulip Tree make up the bulk of the tree growth outside of the oak species and the beech and chestnut. Of the Oaks, the Black Oak, the Chestnut Oak, and the Overcup Oak were observed at different stations along the watershed of the stream. The single station recorded for *Clitoria mariana* in the Upper Midland District is located along this stream. The herbaceous vegetation includes *Impatiens aurea, Sanguinaria canadensis, Vagnera racemosa, Asarum canadense, Arabis canadensis, Impatiens biflora* and *Hypopotis hypopitis.*

Among the species of ferns noted, the following may be mentioned: *Woodsia obtusa, Dryopteris spinulosa, Onoclea sensibilis, Asplenium platyneuron, Adiantum pedatum, Dryopteris marginalis* and *Dryopteris thelypteris.*

The higher and drier slopes of the north side of Sugar Loaf gradually rise from the region of the Creek valley southward from the

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ford at Park Mills. Near the ford, which is flanked by steep sloping banks, the Black Jack Oak is growing in a considerable thicket near the road, with the Hazel Nut and Chinquapin as the border shrubs. The Paw Paw and the Persimmon are not infrequent in the moist cool localities of the deep forest. The Scrub Pine, White Pine and Table Mountain Pine are found upon the slopes of the mountain, and the Pitch Pine on the ground just east of the base, near Thurston.

Bog Pockets.—One of the chief interests in a rapid survey of the slopes and upper portions of Sugar Loaf, is the frequent occurrence in the upper area, of springs or small feeders to the brooks, these running often in shallow beds in the sandstone rock, and there accumulating a soil largely consisting of sand and vegetable remains. In this the peat moss (*Sphagnum*) becomes established, which assists in the further development of soil material. Along the road, well toward the top of the slope, such a peat pocket was examined, and the following plants noted, which may be compared with the flora of the Sandy Upland Swamps of the Eastern Shore District of the Coastal Zone:

Habernaria clavellata
Habernaria psycodes
Drosera rotundifolia
Lobelia cardinalis
Medeola virginiana
Pogonia verticillata
Lobelia syphilitica
Dryopteris noveboracensis

The margins in some cases change abruptly into the dry sandstone soil, in other instances there is a low area transitional between the wet sphagnum and the surrounding dry ground. The plants of the transition area include such as may be present in either of the two adjacent habitats which are able to maintain themselves together where neither has much advantage over the other. In the intermediate zone about the bog pockets, the following plants have

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FIG. 1.—VIEW SHOWING UPPER MIDLAND TOPOGRAPHY IN THE VICINITY OF PARR'S RIDGE, NEAR WESTMINSTER, CARROLL COUNTY.

FIG. 2.—VIEW SHOWING VEGETATION ON THE CUT-OVER SUMMIT OF CATOCTIN MOUNTAIN WITH SCRUB OAK, SCRUB PINE, LAUREL, BAPTISIA AND SWEET FERN.

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been observed, in varying proportions according to the local variations of the habitat:

Rhus vernix
Xolisma ligustrina
Kalmia latifolia
Carex platyphylla
Ludwigia alternifolia
Carpinus caroliniana
Unifolium canadense
Epigea repens
Ascyrum hypericoides
Willoughbaea scandens
Ilex verticillata
Viburnum dentatum
Chionanthus virginica
Panicum capillare
Eupatorium verbenaefolium
Acer rubrum
Trillium erectum
Cypripedium acaule
Campanula aparinoides
Apocynum cannabinum.

Upon the higher parts of Sugar Loaf, the proportion of Chinquapin increases to a considerable extent ranging from the high ground well toward the base on the south slope. In the uncultivated spots to the south, including parts of the lower slope of the Mountain, the following were noted:

Juniperus virginiana
Quercus minor
Quercus digitata
Liriodendron tulipifera
Rhus copallina
Acerates viridiflora
Quercus palustris
Quercus velutina

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Juglans nigra
Rhus radicans
Vitis labrusca
Apocynum cannabinum.

THE MIDDLETOWN VALLEY.

Between Catoctin Mountain and the Blue Ridge lies the Middletown Valley, in the shape of a broad triangle with its base at the south. At the south it has but a slight elevation, gradually rising toward the upper end where it is closed by the convergence of the two ridges. The flat top of the united axes becomes the plateau near Key Rock at Pen Mar, at the head of the Valley.

It is under high cultivation, and needs but little mention here, as the uncultivated plants consist for the most part of the common weeds, or of plants similar to those of the adjacent parts of the Midland Zone. Along the banks of Catoctin Creek, which drains the valley, the plant growth is quite similar to that along the Monocacy to the east of the Catoctin Mountain as shown by the following list:

Ulmus fulva
Robinia pseudacacia
Nyssa biflora
Smilax rotundifolia
Dianthera americana
Ulmus americana
Acer negundo
Fraxinus americana
Smilax herbacea
Urticastrum divaricatum.

The Box Elder is restricted to the ground along the floodplains of the streams, and often forms a very considerable proportion of the tree growth along the canal and river banks, from tidewater at Georgetown to Hancock and extends up the side valleys of the tributaries from the Potomac, as in this case, along the Monocacy and the Catoctin valleys. In the low ground, such as meadow

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pasture lands, *Muscari botryoides* occurs sparingly, and such other vernal herbs as *Bicuculla cucullaria, Chelidonium majus, Asarum canadense,* and *Erythronium americanum* are scattered in the woods.

THE BLUE RIDGE AXIS.

Forming the western boundary of the Middletown Valley, the Blue Ridge extends from Weverton to the Pennsylvania line near Pen Mar. This forms a larger and more rugged elevation at Weverton where the Potomac has cut across it than does the Catoctin ridge at Point of Rocks.

At Weverton a small stream, Israel Creek, flows into the Potomac, and in the deep shade of the bluffs along the lower part of its course some species not previously noted were found. Near the river at the side of the railroad is a high ledge of rock, upon which some plants were found which were not seen elsewhere. These include the following: *Asplenium pinnatifidum, Asplenium platyneuron, Eupatorium altissimum, Asplenium trichomanes, Polymnia canadensis, Ulmus fulva,* together with rank-growing weeds which occupy the talus from the shale and sandstone cliffs. The Yellow Locust, the Chestnut Oak and the Sugar Maple are the principal cliff talus trees, with the Red Bud as under-shrub. *Impatiens biflora,* and *Arisaema triphyllum* are present among the more succulent herbaceous growth.

Along the cliff-like banks of the stream, there are a few spots of deep soil deposited by the water in sheltered places. In these many of the trees are located, and some of the ranker of the herbaceous types. Thus the Black Gum, Buttonwood and Box Elder are associated with the shrubs *Benzoin benzoin, Hamamelis virginiana* and *Viburnum acerifolium.* In the broader places where the stream runs somewhat parallel to the direction of the shale in which it is now flowing, there is a small floodplain developed, on which there is a fine stand of trees, mainly of the same species as already mentioned. But in addition to these, the chief components of the woods, there are a few individuals of the Hemlock, the Sweet Birch, the White Ash, the Butternut, the River Birch, the Black, Chestnut and White Oaks, and the Tulip Tree is also present in well developed trees.

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Along the cliffs themselves, there are alternating bands of more or less poor soil formed by the varying proportions of undecomposed rock and humus. Upon the poorer exposures such plants as *Sedum ternatum* occur, with *Saxifriga virginiensis, Veronica officinalis, Mitchella repens,* with *Dryopteris achrostichoides, Botrychium virginianum,* and *Adiantum pedatum* as the soil ferns, *Polypodium vulgare,* and *Camptosorpus rhizophyllus* as the rock-inhabiting forms. *Celastrus scandens* was here noted, and the following species not common elsewhere were recorded:

Adicea pumila
Circaea lutetiana
Hypopitis hypopitis
Washingtonia claytoni
Parietaria pennsylvanica
Homalocenchrus virginicus
Anychia canadensis
Lippia lanceolata.

In the area more closely adjacent to the Potomac, there were in addition to those just mentioned: *Mollugo verticillata, Euphorbia nutans, Scirpus americana, Cephalanthus occidentalis* and *Asclepias pulchra.* In the shallows of the river, where the earth was exposed at low-water periods, or was just below the surface under the ordinary conditions, the Water Willow (*Dianthera americana*) grows in considerable abundance.

Elk Ridge.

While considering the conditions along the Potomac, it will be simplest to include the next point of botanical interest, and then to follow the forest along the Blue Ridge to the upper end at Pen Mar. A ridge somewhat separated from the main elevation crosses the Potomac just east of Harpers Ferry, and forms the gorge through which the combined flow of the Shenandoah and the Potomac passes eastward. Elk Ridge is the Maryland termination of the Blue Ridge mountain in Virginia which extends for a few miles northward from the river, much as the Catoctin ridge ends

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at some distance from the Potomac on the Virginia side. The elevation which forms the Blue Ridge of Maryland and Pennsylvania runs from Weverton to Pen Mar and thence onward into the latter state. A considerable valley which is drained by Israel Creek, mentioned just above, separates the two ridges at the river. The valley at its mouth is narrow and steep, but a short distance back from the river the south end of the Hagerstown Valley meets the smaller valley of Israel Creek, which thus widens its area of farming land.

The plants to be found upon Elk Ridge differ to some extent upon the east and west slopes, but how far the difference is due to natural variations of soil, and how much is artificial and due to the secondary conditions of difficulty or ease in exploiting the forest of the steeper and of the gentler slopes, cannot easily be determined. The rock exposures on the west slope are steeper and more broken than on the east slope, in those portions of the ridge which have been seen. This is clearly shown at the river section of the Ridge, where the upper Potomac gives to the west face a steepness absent from the other side. The crest is of sandstone as in the case of the ridge at Weverton, the valley between the two ridges is of igneous rock, and the slope toward the Potomac on the west side is largely shale, and is carved by small tributaries into recurring hills and valleys running from the river toward the crest.

The forest cover of the Elk Ridge area is of the oak-chestnut type, and includes among the oak species the following: *Quercus prinus, velutina, rubra, marylandica, alba, minor, acuminata, palustris.*

The Chestnut is common, and the Black Walnut, the Black Gum, the Mockernut Hickory, the Wild Black Cherry, the Tulip Tree, the Elm and the Yellow Locust reaching the size of large trees. Among the species of pine there were noted the Scrub Pine, the Pitch Pine and the Table Mountain Pine; the presence of White Pine was not noted.

Along the shale outcrops of the west face there are a number of small shallow ravines in which the moisture conditions are better than in other places, and in such there is often an abundant development of the Paw Paw. Along the road following the west side of the ridge this is noticeable. Near the river are the usual riverside

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trees, like the River Birch, Honey Locust, Mulberry and Box Elder. On the upper and drier parts of the Ridge, *Kalmia*, *Juniperus*, *Cornus* and *Cercis* are frequent, and *Viburnum prunifolium* is also to be found. Of the herbaceous vegetation the following species were found to be the chief forms present:

Eupatorium coelestinum
Stylosanthes biflora
Cimicifuga racemosa
Euphorbia corollata
Solanum nigrum
Saponaria officinalis
Acalypha virginica
Sericocarpus asteroides
Viola pedata
Chimaphila maculata
Hepatica hepatica
Cassia nictitans
Phytolacca decandra
Silene stellata
Menispermum canadense
Hystrix hystrix
Lobelia inflata
Houstonia purpurea
Baptisia tinctoria
Podophyllum peltatum
Cypripedium acaule.

The species of ferns which were noted were the following:

Adiantum pedatum
Asplenium trichomanes
Pellaea atropurpurea
Woodsia obtusa
Asplenium platyneuron
Asplenium ruta-muraria
Polypodium vulgare
Phegopteris phegopteris
Dryopteris marginalis
Dicksonia punctilobula.

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Of these *Asplenium trichomanes, Asplenium ruta-muraria* and *Pellea* were restricted to a few small outcrops of limestone, along the west slope of the ridge.

In the damp places, where there was less of forest cover *Lobelia cardinalis* and *Mimulus ringens* are found in frequent association, and *Lobelia syphilitica* is usually present.

The Main Axis.—The greater elevation of the body of the Blue Ridge, gives portions of that area a drier character than on the less elevated Elk Ridge, but the character of forest does not differ to any considerable degree until the northern end of the Ridge is approached where there is a tendency toward greater moisture through higher rainfall. The upper portions of both ridges are covered with a nearly continuous forest, but extensive clearings for planting of peach orchards, makes the general appearance of the woodland ragged. The forest fires have also done damage, but there is not as yet the fire type of growth such as was noted for the top of Catoctin, where the Bear Oak was so conspicuous a feature of the region. The valley lands are mostly in good cultivation, but on the higher slopes the soil is often only roughly cleared, and poorly cared for, resulting in a persistent crop of brambles (*Rubus sp.* and *Smilax*) with scattering *Sassafras*. Under the same conditions such rank weeds as the *Phytolacca decandra, Datura stramonium, Echium vulgare, Chenopodium album, Solanum carolinense* are found in considerable abundance.

Roadsides.—Along the roads where there are scattered trees, very often of the Black Locust, there are occasional clumps of the Sweet Sumach which closely resembles its poisonous relatives, the "Poison Ivy," but has more hairy twigs and fruit. *Anthemis cotula* is a common plant where there has been considerable traffic, and *Malva rotundifolia* occurs about the dooryards of the farm-houses. Near the barns and other buildings *Xanthium spinosum* is not rare, and *Dipsacus sylvestris* is scattered along the pikes. The roadside grass is a feature of the herbaceous vegetation both in the Hagerstown and in the Frederick Valleys. It extends as a turf from the fields to the actual roadway of the pikes and other roads, even in thin soils. This cover of *Poa pratensis* when not cut and broken by

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teams greatly reduces the washing of the roads. The turf formed is too compact for most plants to penetrate, and the grass thus acts directly as a check upon the abundance of weeds which in many other places make the sides of the roads their habitat. In the marshy places along the streams, there are usually margins of *Nepeta cataria,* and in less frequent cases *Roripa nasturtium* is found in the meadow streams.

In the neighborhood of Boonsboro, near Turners Gap, the forest was found to be composed of the following species, with the first forming much the larger proportion and the last two occurring only near the streams:

Castanea dentata
Quercus velutina
Quercus alba
Juglans cinerea
Pinus strobus
Liriodendron tulipifera
Platanus occidentalis
Quercus prinus
Quercus rubra
Hicoria ovata
Fagus americana
Pinus virginiana
Juglans nigra
Nyssa biflora.

On the slopes of the hills the several species of *Crataegus* occur with some frequency, chiefly, however, *Crataegus crus-galli, Crataegus oxyacantha* and *Crataegus coccinea.* They are severely attacked by a rust which infests both foliage and fruit and also but less commonly the young shoots, making the trees conspicuous at a considerable distance by the discoloration from the fungus.

Moist Areas.—The character of the forest is quite uniform from Weverton to Turners Gap, and for some distance to the north of that point; but near Wolfsville there is an apparent increase in the moisture content of the soil and of the atmosphere also, resulting

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FIG. 1.—VIEW SHOWING ROADSIDE ON UPPER SLOPES OF CATOCTIN MOUNTAIN WITH SCRUB PINE, CHESTNUT OAK, LAUREL AND SWEETFERN.

FIG. 2.—VIEW SHOWING THE POTOMAC RIVER NEAR HARPER'S FERRY WITH DIANTHERA ALONG THE BANK.

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in the increase in the number of humus-loving plants, and of succulent herbaceous undergrowth. A typical spot of this character is found along the route of the trolley from Myersville to Hagerstown, close to the top of the gap by which the road passes over the Blue Ridge mountain (Plate XXII., Fig. 2.)

Standing water, and slow moving and shallow streams are found at several points along the tracks, and furnish a rather uniform list of plants for the several places. Sphagnum is one of the components of the upland bog, and the Swamp Blackberry (*Rubus hispidus*) is usually present with *Acer rubrum,* and the *Osmunda regalis.* The small-flowered bog orchid, and its more showy relatives *Habenaria clavellata, Habenaria lacera* are here in the edges of the wet ground, within the shade of the woods, and at a little distance from the damper spots there is an abundance of the Whorled Orchid, (*Pogonia verticillata*) growing in the humus of the chestnut-oak forest. *Monotropa uniflora* assists the other humus plants in decomposing the fallen leaves into wood soil, and is found here in large colonies. The various Ericaceous plants, as *Vaccinium, Gaylusaccia, Epigaea, Azalea, Kalmia, Leucothoe, Xolisma* and *Gaultheria* are distributed through the area and supply much of the more shrubby undergrowth. Both *Xyris flexuosa,* and *Sisyrinchium graminoides* are to be found in the immediate vicinity, and a rare plant of *Isoetes englemanni* may reward a careful search. The list of species does not add materially to those previously recorded, the increase in frequency of the moisture loving, and the corresponding lessening in the numbers of drier ground plants, being the chief change that is noticed. The woods are still of Chestnut and Oak, and the other species present do not show great differences from previous stations. Here the Tulip-Tree is somewhat less common than at some of the other places visited. There is but a small amount of pine in the forest, but an occasional stand of White Pine is to be found on some exposed places, also Scrub Pine and Black-Jack Oak and rarely Table-Mountain Pine are to be discovered.

On the cut-over slopes of the mountain a considerable degree of reforesting is in progress through the self-seeding of the Locust, which has already been noted in several localities as a fence-row

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tree. Here it is present in a considerable abundance in the forest, and when open land is abandoned, it is an important tree in the reforestation.

Along the Ridge toward the north, or north-east, the conditions continue much the same, occasional bog pockets in the sandstone surface, with the plants already recorded in nearly constant variety. Upon the upper portions of the ridge, in places having good soil and considerable shade, the Paw Paw occurs in extensive clumps, as it did in similar situations on Elk Ridge.

In the drier woods the *Corallorhiza multiflora* is occasional and *Cypripedium acaule* occurs in pine-needle soil. Scattered through the forests *Porteranthus trifoliatus, Medeola virginia, Elephantopus nudatus* and *Dioscorea villosa* are rather common.

Boulders.—The upper end of the Blue Ridge is of interest because of the presence in several places of "Rivers of Rocks" located high above any present watercourse. These are collections of water worn boulders, marking the bed of some ancient river, now abandoned through the cutting of new channels across the earlier channels. The "river" may be several rods in width, and show no evidence of water beyond the rounding of the boulders, and the sound of a trickling stream at the bottom of the bed of rock, out of sight below the lichen covered fragments. One such area is located between Smithsburg and Wolfsville, in which the rocks are not of great size. A more striking one is near Riven Rock, to the south of Edgemont, in which the rocks are large, some of them not fully rounded, but all worn by the action of the stream. (Plate XXVI., Fig. 1.)

The lichen covering of these rocks is largely of *Umbilicaria,* which grows to the size of a disc six inches in diameter upon these exposed rocks where there are few accidents to break the growing thallus. Along with this *Umbilicaria,* there are of course the smaller species, that are usually associated with the sandstone rocks, and adhere closely to the rock surface. The general trend of the drainage which is represented by these channels, is toward the south-east, while that of the present streams in the same area is south-westward.

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On the road to the summit of the Blue Mountain, at Pen Mar, there is exposed a similar mass of rock fragments, but these are not rounded, but are scattered over the face of the cliff and adjacent steep slope. (Plate XXVI., Fig. 2.)

There is no high cliff for these fragments to have fallen from, but the flat top of the mountain is composed of the sandstone layer already mentioned, which extends southward on Catoctin, and was noted at Weverton and Elk Ridge. Below this top layer, shales occur which disintegrate with greater rapidity than does the sandstone, and thus allow large fragments of the latter to fall as talus. The northwest face of this mountain is closely covered by these great masses. In the soil which collects in the spaces between the rocks and is maintained by the fallen leaves, there is a good stand of oak and chestnut forest. The soil is nearer the upper surface of these talus slopes than in the case of the rock rivers; for in these the action of the running water has kept the fine particles of disintegrated rock or decaying leaves from accumulating. It will be a very slow process of invasion from the sides following the accumulation of minute quantities of soil along the margins, which will result in the covering of the rock rivers with tree growth. The talus fragments by contrast fall upon soil already in place, and even when close together allow the seeds of plants to reach the ground easily, and tend to cover such with the falling leaves of each season as they gather in the spaces between the rocks. The water-worn rocks are more closely placed, lying in the dry bed of the deserted river to a depth, apparently, of ten feet or more, and it is only rarely that seeds of trees or smaller plants falling upon this area can germinate and reach the upper surface.

The forest conditions at the north end of the Blue Ridge are much the same as at the points reached from Thurmont; there is a considerable proportion of Hemlock, White Pine, and occasionally a Cucumber Magnolia. Along the roads there are the same forms which have been noted before, including *Comptonia* and *Rubus odoratus*. In the bog pockets *Veratrum viride, Tofeldtia glutinosa* and *Aletris farinosa* are added to the lists from other stations. These bog pockets are nearly uniform in being formed in the depressions on the upper surface of the sandstone, which is

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often coarse like fine conglomerate, and therefore having a pure white sand or fine gravel, as the soil constituent of the bog. Most of the bog plants already mentioned are found here, but one addition to the tree list is of value. In the forest near one bog on the eastern face of the mountain, between Buena Vista and Pen Mar, a single specimen of the Holly which is rare in the Midland Zone was seen.

Hagerstown Valley.

In the deep soil of the alluvial bottoms of the wider valley there is a considerable amount of the *Mertensia virginica* in the thickets near the Witch Hazel and Hornbeam. The Dogwood is abundant upon the slopes, and the Beaked Hazel occasional along the roads.

Cavetown.—A little to the west of the end of the Ridge, at Cavetown, there is a considerable outcrop of limestone, which is associated with some few changes in the flora of the region, but these changes are not of such a character as to introduce new species, but rather repeat what has already been seen upon the limestone areas of the Frederick Valley. It is chiefly of interest through the occurrence there of *Asplenium ruta-muraria,* the previously recorded station for which is the road to Harpers Ferry, on the west slope of Elk Ridge. Large quantities of Locust are associated with the calcareous soil, as about Westminster, but there are few modifications in the plant-cover of the hills.

The Valley Floor.—The region from Cavetown west to North Mountain has little interest to one looking for the original plant-life of the state, for the wide valley between the two bounding ridges is almost wholly in cultivation, and the woodlots, which were quite a feature of the upper Frederick valley, are much less frequent here. The grassy roadsides, remarked upon previously, continue through this section and reduce the land surface upon which the wild plants are to be found in other regions. Where there are strips of uncultivated land they are usually occupied by the Yellow Locust as the first tree, and by such shrubs as the Sumacs, Choke Cherry, and in low spots by the Alder. The Elm is somewhat more common than is the case in the other parts of the state and the Ailanthus is occasionally found as an escaped tree.

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The trees in the groves or wood lots of the farms, are of the same varieties as have been already discussed, the several Oaks, Hickories, Chestnut, and more rarely the Butternut and Black Walnut. The amount of Hickory and White Oak is less in the region about Hagerstown than to the east or south of it, because of their demand at that place for the wheelwright and coopering trades. The remaining trees are thus of the less valuable species, and in culled condition, as the better types have already been removed, leaving only the poorest species, and of these often the poorest individuals, to represent the original forest cover.

Among the plants that have been noted in the open valley, the following are common:

Hedeoma pulegioides
Dipsacus sylvestris
Monarda fistulosa
Sida spinosa
Parsonsia petiolata
Daucus carota
Rudbeckia hirta
Datura stramonium
Bidens bipinnata
Linaria linaria
Echium vulgare
Achillea millefolium
Nepeta cataria
Anthemis cotula
Cichorium intybus
Verbesina occidentalis
Chrysanthemum leucanthemum
Verbascum blattaria
Clematis virginica.

Conococheague Valley.—Toward the west side of the Valley a shale belt occurs which changes the general character of the soil, but as the plant life is so largely that of the weed type, and to so large an extent independent of soil conditions, there is little to

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note in connection with the changed soils. At several points along the line of contact between one of these belts of shale and the adjoining one of limestone on the west, the Conococheague River has carved its valley, leaving on one side considerable bluffs of the hard rock, facing the lower level of the shale land on the opposite side of the stream. On such a bluff, near Broad Fording postoffice, there is a large grove of Red Cedar covering several acres of ground to the nearly complete exclusion of other plants. (Plate XXVII, Fig. 1.) The river bed lies mainly in the shale area, but follows the line of contact again at the crossing of the National Pike, where it has produced a considerable cliff of limestone on the west bank, with a lesser one of shale on the east. On both the Red Cedar occurs singly or in small clumps, rather than as a grove like that mentioned above. Along the banks of the stream between the two places there were noted the following species: *Lychnis githago, Achillaea millefolium, Papaver rhoeas, Plantago rugelii, Oxalis stricta, Echium vulgare, Erigeron annuus, Plantago lanceolata, Lactuca scariola* and *Cynoglossum officinale,* beside the grasses and weeds more common in moist and deep soil.

The conditions from the River to North Mountain are like those about Hagerstown, where the land is under cultivation, and only a few forms are able to meet the struggle with the turf forming grasses along the roadside, or the competition of the cultivated crops within the fields. Such plants as do make a successful struggle, are the same kind as have been previously recorded and will not here be repeated, there being no novelties to add to the lists made out for the eastern side of the Valley.

Williamsport.—The Conococheague flows into the Potomac at Williamsport, and along the latter there is a line of cliffs which are covered by a series of plant forms, somewhat different from those seen at other places, though closely related to the types seen along the river near Harpers Ferry. The apparent difference may be due in some measure to the difference of several weeks in the time of examining the two localities, as well as to inherent differences.

Among the plants which were seen along the high canal cliffs, or on the ground between the canal and the river near the mouth of the Conococheague, the following deserve mention: *Sedum acre* is

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abundant upon the abutments of the canal bridge, and upon the nearby cliff to a slight extent, *Dianthera americana* is common in the margins of the Potomac, and near the mouth of the tributary stream, forming compact beds close to the water, or just below its surface, and the following additional species were noted:

Allium cernum
Ambrosia trifida
Cuscuta gronovii
Verbena hastata
Asclepias quadrifolia
Woodsia obtusa
Viburnum dentatum
Pellaea atropurpurea
Parthenocissus quinquefolia
Micrampelis lobata
Acer negundo
Tradescantia virginica
Linaria linaria
Aquilegia canadensis
Asplenium trichomanes
Physalis heterophylla.

Considerable seepage from the canal makes the ground below it almost swampy in places, but no rare or unusual species were noted, as these areas are usually accessible for use as pastures, or if too steep for the latter, then covered with the normal river bank vegetation in somewhat greater luxuriance than in the drier places. Many weeds become established along the canal, about the feeding places of the canal boat teams, but as the plants so established are of the common species to be seen in the hayfields or along the roadsides elsewhere, it is hardly necessary to list them.

North Mountain.

The slopes of North Mountain are flanked by a series of lesser hills and intervening valleys, in which the moisture conditions are favorable to a rich growth of forest, and of herbaceous undergrowth. There are few spots of sandstone bog pockets, such as were found

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in the Blue Ridge region. There are, however, places where the surface of the ground affords a basin in which water has accumulated for a long period and now presents the condition of a Leucothoe-Andromeda pond, with little or no Sphagnum about the margins; in these bogs there is no such development of the typical flora as has been found in the other places, there is more standing water and much less of the saturated layer of peat and humus that is characteristic of the pockets in the Catoctin and Blue Ridge regions.

The cultivated land of the Hagerstown Valley extends to the base of the flanking ridges of North Mountain, and ends with abrupt transition into the forested slopes. There is lacking the intermediate condition of cut-over woodlands between the standing forest and the tilled or pastured farm lands, so that the farm ends suddenly against the dense tree-covered slopes of the hills. In many cases there are cleared fields higher up on the sides of the mountain, but such are usually separated from the wide valley land by intermediate woods, so that the general effect is not lost by these advance farms. The woodland soils are usually rich, and have a high content of humus, though this is subject to local conditions according to the care with which the owners of the several areas exclude forest fires from their woodlands. The top of the mountain is as before, of massive sandstone, breaking up into large boulders.

Fairview.—The south shoulder of North Mountain is known as Fairview, and is farmed nearer to the top than at many other places. The National Pike passes the farm house, and the outlook at this point gives one the characteristics of the two sections of the state. To the east and southeast, the cleared lands extend throughout the breadth of the Great Valley, as far as the west side of the Blue Ridge which is hidden in the blue haze, nearly twenty miles away. The valley is under almost complete cultivation, the scattered woodlots which are irregularly distributed over the area being almost the only uncultivated areas, and these are not natural in their composition, because of the selective cutting which has been done by the owners, as has already been stated. To the west an outlook of striking difference is afforded; for the land surface is in the form of closely succeeding ridges, covered by forest to their tops, with a clearing here and there where a farm is dropped as it were into the

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FIG. 1.—VIEW SHOWING THE CHESAPEAKE AND OHIO CANAL NEAR HANCOCK AND THE CHARACTER OF THE VEGETATION ALONG THE BANKS.

FIG. 2.—VIEW SHOWING FOREST CHARACTERISTIC OF THIN SOILS IN THE LOWER BLUE RIDGE WITH BLACK JACK OAK, RED CEDAR AND PITCH PINE, NEAR DARGAN, WASHINGTON COUNTY.

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thick of the trees. In this direction the outlook may extend, if the air is especially clear, to Sideling Hill about sixteen miles distant.

The ridges between these two heights consist to a large degree of shales, and are left in their forested condition because of the unsatisfactory character of the soils for farming purposes, and afford therefore an opportunity for seeing the character of forest which is likely to have been common in the whole Upper Midland Province at the time of the settlement of St. Mary's City by the first Maryland Colonists.

Valleys.—In the valleys formed between the main elevation of North Mountain and the subordinate ridges on the east side, there are present such trees as are indicated in the list below, and it will be noted that the species represented are not materially different from preceding woodland lists. There is, however, a considerable difference, not evident in the enumeration of species, due to the proportions of the chief members of the forest flora, although there is close similarity between this and the east side of the Blue Ridge, near Sabillasville or Buena Vista. The following species may be mentioned:

Castanea dentata
Hicoria ovata
Platanus occidentalis
Cornus florida
Pinus pungens
Pinus virginiana
Liriodendron tulipifera
Hicoria alba
Juglans nigra
Nyssa sylvatica
Hamamelis virginiana
Tsuga canadensis
Quercus prinus
Quercus alba
Quercus coccinea
Quercus velutina
Cercis canadensis

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Pinus rigida
Pinus strobus
Acer saccharinum
Juglans cinerea
Acer nigrum
Alnus rugosa.

In the smaller growth there are lacking some of the species which were not infrequent further east, as the Bear Oak here rare, the Chinquapin (one station only found), *Comptonia peregrina* (infrequent) and *Rubus odoratus* (seen at one locality).

There are a number of outcrops of the white sandstone of the Tuscarora formation, such as occurs in Wills Mountain at Cumberland, and the rocks that occur in the woods are chiefly of a similar character, and bear numerous patches of *Umbilicaria* and other lichens.

The herbaceous plants of the drier areas include the following forms:

Trifolium arvense
Dianthus barbatus
Anagallis arvensis
Stylosanthes biflora
Abutilon abutilon
Plantago rugellii
Plantago major
Erigeron canadensis
Verbascum blattaria
Lespedeza repens
Echium vulgare
Lupinus perennis
Malva rotundifolia
Sida spinosa
Plantago lanceolata
Erigeron annuus
Verbascum thapsus
Xanthium spinosum
Anemone virginica.

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In the more moist places of the deep or shady valleys the plants like *Vagnera, Dioscorea, Monotropa, Botrychium virginianum, Geranium maculatum, Polygonatum biflorum* and *Oakesia* are common. Along the roads *Baptisia* is associated with the *Gaylussacia* as at the other stations, and occupies similar situations. *Kalmia* while still common does not form so large an element of the shrubby growth as was the case on the Blue Ridge.

On the road from North Mountain to Fort Frederick, however, there are drier areas than in the immediate vicinity of the Mountain, and in such there is an abundance of Kalmia and Bear Oak, often associated with young Pine on hillsides cut over within a few years. (Plate XXVIII., Fig. 1.)

Roadsides.—Along the roadsides, adjacent to the wooded areas there is an abundant vegetation somewhat different from that seen elsewhere; a large proportion of *Dicksonia* forms conspicuous displays along the fence rows, while the shrubbery consists of *Sassafras, Rubus, Pinus,* and a few oak saplings, the whole forming what the landscape gardener would call a "Border Planting" though here naturally developed. (Plate XXVIII., Fig. 2). The Laurel is often set off in such a background to the best advantage, and if this is present in the border, the Sweet Fern is likely to be present nearby. The soils upon which this association of species occurs is usually a weathered shale, and the best examples were seen near Hancock, along Pig-skin Ridge.

Shale Ridges.—The soil conditions between North Mountain and Hancock are unfavorable to extensive farm operations, hence the land has been largely left in forest, especially upon the shaly ridges. The forest composition changes somewhat, and there is an increase in Scrub Pine and Table-Mountain Pine. The State at this point is narrow from north to south, and there is not sufficient distance between the high ground and the Potomac to give any considerable amount of level land, the stream erosion working upon the shale soils to produce steep-sided valleys and usually narrow topped ridges. These ridges tend to unite toward the north at the head of the comparatively short drainage basins of the small streams between them and then the land surface becomes more level, and

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better adapted to agriculture, the forest in general being cleared away in proportion to the gain in levelness of the country.

A considerable stream enters the Potomac from the north two miles east of Hancock, the Big Tonoloway, and this has cut a rugged valley through the shale, the sides of which are clothed with a good forest of the deep soil type: Hemlock, Beech, River Birch, Scrub Pine, White Pine, Tulip Tree, Chestnut Oak, Sugar Maple, the Arrow-woods, (*Viburnum dentatum, Viburnum prunifolium,* and *Viburnum acerifolium;*) with *Hamamelis virginiana, Alnus rugosa, Hydrangea arborescens* and *Kalmia latifolia* as the smaller forms.

The first station seen in the Upper Midland for *Rhododendron maximum* is on the bank of this stream, upon an exposed bluff and associated with *Sedum ternatum.* In the bed of the stream there is the characteristic growth of *Dianthera* which has been found along the Potomac at other stations.

Of the herbaceous vegetation, there is nothing of note as peculiar to the area at hand, the lists already given covering the forms seen. Along the roads, especially the main turnpike, *Hypericum prolificum* is abundant in mid-summer; and in the fields, *Echium vulgare* is perhaps the worst of the common weeds.

Rhus aromatica which was found in the Elk Ridge region, is occasional here, with *Rhus glabra,* and *Rhus copallina,* as well as *Rhus radicans* common on the fences and edges of woods. The Elm is rather frequent in the low grounds, especially near the river, and the Box Elder occurs as before along the river bank, with the additional associate here of the Bladder-nut.

Round Top.—An extensive outcrop of limestone is found to the southwest of Hancock, at Round Top, and here there is a considerable change in the lists of plants observed. The river slope of the hill is steep, and well covered with forest, the land side is not so steep, and the trees have been culled more thoroughly. The forest on the river side of Round Top, consists of the following species:

Acer saccharum
Quercus prinus
Quercus coccinea
Juglans cinerea
Cornus florida

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Hamamelis virginiana
Tilia americana
Quercus alba
Hicoria microcarpa
Liriodendron tulipifera
Viburnum acerifolium
Hydrangea arborescens.

The Linden here first becomes a factor in the forest, in this case reaching 15% to 20% of the stand. In previous occurrences the presence of this tree was merely as a constituent of the woody flora and not as a timber tree.

The herbaceous vegetation does not change to a great degree, but *Panax quinquefolium* is still present in sufficient abundance to be found by a few minutes' careful search. It occurs in the upper portions of the Blue Ridge, but is now so infrequent as to escape discovery, unless one spends hours in the search. The herbaceous plants include the following:

Campanula americana
Scrophularia marylandica
Sanicula marylandica
Parthenocissus quinquefolia
Celastrus scandens
Asarum canadense
Asplenium platyneuron
Adiantum pedatum
Botrychium virginianum
Aster divaricatus
Phlox subulata
Washingtonia longistylis
Washingtonia claytoni
Cimcifuga racemosa
Dioscorea villosa
Dryopteris marginalis
Dryopteris acrostichoides
Sanguinaria canadensis
Circea lutetiana
Podophyllum peltatum.

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Upon the summit of Round Top, there is a drier type of habitat and the following plants occur:

Quercus prinus
Pinus virginiana
Pinus strobus
Robinia pseud-acacia
Quercus velutina
Pinus pungens
Juniperus virginiana
Cercis canadensis.

In the localities where the soil was deeper, the species which were recorded for the river-slope were also found on the sides of the hill adjacent to the latter. The herbaceous growth included the following forms, the first one named being in a large colony or patch covering a quarter acre or more of the summit of the knob, and close to the outcrop of the limestone, spreading downward on the gentler slope of the northern side:

Dodocatheon meadia
Anemone virginiana
Arabis canadensis
Silene inflata
Houstonia purpurea
Astragalus carolinianus
Camptosorus rhizophyllus
Asclepias quadrifolia
Aquilegia canadensis
Conopholis americana
Campanula americana
Cynoglossum officinale
Cynoglossum virginicum
Draba ramosissima
Clematis viorna
Cimicifuga racemosa
Pellaea atropurpurea
Veronica officinalis
Cubelium concolor
Leptamnium virginianum.

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The slope on the northwest face of Round Top is sufficiently gentle to be easy of ascent for much of the distance, and the land is cleared over much of this and the adjacent hill sides. Along the road the white violet occurs in considerable abundance, and in the drier places the roadside legumes, like *Medicago lupulina, Stylosanthes biflora, Baptisia tinctoria,* while in the edges of the woods and on stretches of sandy soil the Lupine is occasionally found.

Tonoloway Ridge.

The hills adjacent to Round Top have been cleared to a considerable extent, and there are plantings of apple and other orchard trees in the place of the forest trees. To the west of Round Top a few miles lies the high ridge of Sideling Hill, topped as in the case of the previous heights, with sandstone, and like them flanked along the base by smaller ridges. The Hill as well as the subordinate ridges, are well covered by trees, and there are a few small streams running parallel to the axis of the ridges affording drainage to the slopes. One such stream is the Little Tonoloway creek, which flows through a rather broader valley than do some, and is flanked by occasional farms, chiefly on the west side of the stream. The east bank is a steep and wooded ridge which rises rapidly from the creek. The forest cover in this case is thin, and contains a large amount of Scrub Pine saplings of pole size. The steeper face of the ridge is sandstone, the more gentle slope toward the east has some shale, and hence may be cultivated.

The following species have been recorded upon the sandstone slope of this ridge:

Pinus virginiana
Pinus strobus
Quercus rubra
Castanea dentata
Amelanchier canadensis
Gaylussacia resinosa
Mitchella repens
Pinus rigida
Quercus alba

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Quercus phellos
Quercus velutina
Quercus nana
Kalmia latifolia
Gaultheria procumbens
Epigaea repens.

Along the banks of the creek, there are to be seen the following additional forms, which include those of the bottom land not in the immediate vicinity of the flowing water, but in places of good moisture:

Pinus virginiana
Fraxinus americana
Juglans cinerea
Carpinus caroliniana
Ilex verticillata
Pinus strobus
Hicoria alba
Acer saccharinum
Alnus rugosa
Ulmus fulva.

In the bottom alluvial soil of one of the tributary creeks, a group of *Arisaema dracontium* was found in association with the following species:

Ulmus fulva
Fraxinus americana
Celtis crassiflora
Impatiens biflora
Washingtonia longistylis
Platanus occidentalis
Morus rubra
Ambrosia trifida
Verbesina occidentalis
Adicea pumila.

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FIG. 1.—VIEW SHOWING A ROCK RIVER WITH UMBILICARIA AND OTHER LICHENS, NEAR BUENA VISTA, FREDERICK COUNTY.

FIG. 2.—VIEW SHOWING TALUS ROCKS IN FOREST, NEAR PEN MAR, WASHINGTON COUNTY

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One of the most cosmopolitan of the ferns is *Asplenium platyneuron,* which occurs at frequent intervals in the woods, or more noticeably along the roads, and similarly open localities, with no evident regard to the soil upon which it may be growing. Thus if the roadside is of good soil depth, as at the base of a moist hill, the plants there will be of good development and be associated with grasses and sedges. If the habitat is the dry exposure of massive shale, as along the road over Sideling Hill, the associated plants will probably be *Polypodium, Asplenium trichomanes, Aster divaricatus, Aquilegia canadensis, Quercus velutina* (in the adjacent woodland) and *Phlox subulata* (on the edges of the exposed shale). By contrast, the selective habit of the two species, *Asplenium pinnatifidum* recorded only at Weverton, and *Asplenium ruta-muraria,* at Weverton, Cavetown, and Blairs Valley, northwest of Clear Spring, show a low degree of adjustment of the life factors that control growth, to the conditions in which the plants may find themselves. A noticeable feature in this narrow range in adjustment is that the habitat in which the plant is able to become established is one of extreme unfavorableness, as judged by other plants which are so largely absent in these latter cases from the immediate environment of the plant mentioned.

The upper portion of Sideling Hill is sandstone, and is therefore covered with the dry forest such as already has been listed from several localities. Some of the areas upon the Hill have been culled over so as to leave a poor representation of the original forest cover, but the species represented are not materially different from those of this type on Tonoloway Ridge. A few herbaceous plants not previously recorded were noted as: *Senecio obovatus, Eupatorium sessilifolium, Agrimonia pumila, Potentilla canadensis.*

There is a considerable valley to the west of Sideling Hill, but it is narrower and more uneven than that about Hagerstown, which has a floor in the form of a wide and comparatively level trough. The former consists rather of a complex of small valleys associated in one great one, the component units separated by hills and ridges, so as to make the valley floor a rolling or undulating surface between Sideling Hill and Martin's Mountain.

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On the slopes of the wooded hills, the forest is largely of the types already seen, but there is an increase in Hemlock, Pitch Pine and White Pine, and along the steep sides of the stream banks, the *Rhododendron* occurs in greater frequency, displacing to some extent the Laurel which has been present under much the same conditions heretofore, and from now on shares the hill sides and exposed situations with the larger shrub.

Sideling Valley.—The creek at the west base of Sideling Hill bears the same name as the hill along which it flows, and forms the boundary between Allegany and Washington counties. The land surface from this point to the limit of the Upper Midland, and the beginning of the Mountain Zone, is much more uneven than that heretofore seen, the units are larger, and the heights reached by the successive hills or ridges is much more than has been the case with the shale ridges of the region between North Mountain and Sideling Hill. There is less of agricultural modification of the original conditions here than in the previous areas, and the forest is evidently more nearly in its original assortment of species on this account. However, even in this area, the land has generally been cut over at least once, and is now receiving the saw and axe upon the second growth timber. Much injury is being done in the forest, by the careless methods of lumbering, both in the felling of the trees, by destroying and breaking young trees; and by cutting the trees which should be left for the next crop of timber.

The commercial trees of the forest, at the present time seem to be anything over six inches diameter, with slight choice of species. All this is greatly modifying the character of the vegetation of the area, but just what the changes are can be learned only by a continued series of observations over a considerable period.

So far as could be determined, the forest species were much the same as in other places, but there is an increase in the number of such trees as the Cucumber Tree, the Black Jack Oak and the Yellow Oak (*Quercus accuminata*). In addition, there were observed the following species: White Oak, Chestnut Oak, Black Oak, Scarlet Oak, White Pine, Scrub Pine and Pitch Pine, Black Maple, Sugar Maple, Red Maple, Bladder-nut, arrow-woods (*Viburnum prunifolium, Viburnum acerifolium*), Large-toothed Poplar, and

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Black Gum. Of the undergrowth, there was an abundance of *Phlox subulata,* in both the white and the pink flowered forms, *Eupatorium coelestinum, Lacinaria scariosa, Lacinaria squarrosa,* and *Cunila orginoides.*

There is much less of the roadside weed vegetation, such as is abundant in the areas already discussed, the Teazel, Chicory, Thistle and Blue Weed being much less common. This is due to two causes, of which the more important is the decreased amount of hauling of farm produce, from which the seeds may be scattered along the route traversed; the second is the presence of hardy plants along the edges of the woods which tend to resist invasion by the plants of the agricultural areas. The weeds of the woods come out into the open along the roads, and replace the more common forms. Among the latter were *Cunila origanoides, Hypericum prolificum, Asclepias quadrifolia, Anemone virginiana, Aralia nudicaulis, Parsonsia petiolata,* and *Dasystoma laevigata.*

Town Creek.—In the neighborhood of Flintstone there is a considerable area of rather level bottom land which is in farms, and extends along the valley of Town Creek toward the Potomac, becoming wider as the river is approached, the soil being mainly of weathered Romney shale. Along the edge of the woods, following the valley southward from Flintstone, the following species were recorded:

Quercus acuminata
Hicoria ovata
Nyssa sylvatica
Liriodendron tulipifera
Tilia americana
Ulmus americana
Quercus alba
Acer rubrum
Pinus strobus
Quercus marylandica
Tsuga canadensis
Robinia pseudacacia.

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And in the way of smaller growth the following plants were found:

Corylus rostrata
Amelanchier canadensis
Hamamelis virginiana
Cornus florida
Azalea nudiflora
Rubus odoratus
Crategus sp.
Sassafras sassafras
Kalmia latifolia
Benzoin benzoin.

The ferns include the following species:

Polypodium vulgare
Asplenium platyneuron
Asplenium filix-foemina
Dryopteris marginalis
Adiantum pedatum
Dryopteris noveboracensis
Dryopteris spinulosa
Phegopteris phegopteris.

There were the usual herbaceous plants associated with the more woody forms, and the following were noted as not infrequent:

Uvularia perfoliata
Cimicifuga racemosa
Lobelia cardinalis
Meibomia nudiflora
Vagnera racemosa
Lobelia inflata
Lobelia syphilitica
Polygala verticillata.

To the northward from the same locality, there is a ridge of higher ground which extends nearly or quite to the Pennsylvania

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line (Iron Ore Ridge) and upon the sandstone soil of this higher ground the more hardy plants were in predominance, such as are listed here:

Pinus virginiana
Pinus strobus
Quercus alba
Quercus prinus
Quercus coccinea
Rhododendron maximum
Cunila origanoides
Thaspium trifoliatum
Trifolium arvense
Pinus pungens
Quercus nana
Quercus marylandica
Quercus velutina
Hicoria alba
Acer nigrum
Lacinaria squarrosa
Phlox subulata
Houstonia purpurea.

Just to the west of the village of Flintstone, a creek of the same name occupies the bottom of an irregular valley extending northwesterly into the region of Bedford County, Pennsylvania. On the shale cliffs, along the lower half mile of this creek, there is a considerable scattering of Red Cedar, and in the flood-plain nearby, there is a colony of half a dozen Willow Oaks. Both of these trees appear to be out of their natural habitat, the last particularly; but a little investigation indicates that the Oak at least, has probably been seeded by the overflow waters of the creek, depositing acorns picked up in some of the upper portions of its drainage basin, because the tree is recorded as rather common over the Pennsylvania line. *Platanus occidentalis* is rare, but occurs in the broader valley to the east.

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Cumberland Hills.

Following the road toward Cumberland, after crossing the west valley, there is a hill known as Martin Mountain, upon the slope of which there is an outcrop of limestone. In the vicinity of this outcrop, the following species were noted:

Pellaea atropurpurea
Camptosorus rhizophyllus
Saxifraga virginica
Aquilegia canadensis
Hydrangea arborescens
Acer saccharinum
Cercis canadensis
Woodsia obtusa
Campanula americana
Anemone virginiana
Allium cernuum
Asimina triloba
Acer saccharum
Sanguinaria canadensis.

On account of the steepness of many of the stream valleys, the lower portion of the slopes are often damp and support a luxuriant vegetation, but the species present are not often of conspicuous difference from those of the somewhat dryer but otherwise similar habitats. The differences in the humidity are often shown in the development of the lower forms, like the Liverworts, Mosses, and damp soil Algae, especially of the blue-green group. Of the higher forms the low and moist places show such plants as *Spathyema, Veratrum* and *Sagittaria* or *Alisma,* although none of these are as common as in the localities at less elevations.

Between Martin Mountain and Cumberland there is but little of note; the region is a rolling one, with the more gentle slopes and the uplands tilled, the steeper slopes and the steep valleys in general left in forest. The rugged character of the country encourages the washing of the roadsides by the rains, and thus there is less of that type of vegetation through this territory than was the case to the east of Sideling Hill. As in the region discussed in connection with

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the Sideling Creek Valley, so here the vegetation of the roadside is largely of the forest plants, rather than of the farm weeds, there being but little of the turf noted in the Hagerstown Valley. The soil is too easily washed to develop a turf along the roads, and even in the fields it is not so easily produced as in the limestone soil of the eastern section. The general trend of the drainage in the areas discussed has been southward, with the side valleys of the main streams cutting into the long ridges. This characteristic of the drainage continues to the limit of the Midland Zone, at Wills Mountain.

Cumberland.—In the neighborhood of Cumberland the influence of the demand on the part of the coal mines for timber and small props is seen in the more numerous stripped hills and exposed slopes from which the forest cover has been removed. The great Georges Creek area of coal lies only a few miles to the west, and this locality has long been the distributing point for the coal and for the mining supplies. There is not a great deal of good agricultural land in the vicinity, on account of the large amount of sandstone present over much of the area, while elsewhere the shale soil of the Romney formation furnishes almost equally poor farm land.

Wills Mountain.—The great point of interest lies just west of the city, in the high ridge of Wills Mountain which is cut through by Wills Creek, both banks of the Creek being used as roadways to reach the country beyond. The Mountain is cleared for much of the distance from base to top on the eastern face, but as the west side is much steeper, and cannot be tilled, it remains in scattered forest, of such hardy trees as *Robinia pseud-acacia, Quercus prinus, Quercus velutina, Pinus virginiana, Kalmia latifolia, Amelanchier canadensis, Pinus pungens* and *Quercus rubra.*

In the way of herbaceous vegetation in the immediate vicinity of the Mountain, and the Creek banks, there are the following species, at times in some luxuriance as some small spring may bring the needed water into easy reach:

Bicuculla eximia
Mertensia virginica
Viola pedata
Sanguinaria canadensis

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Phlox subulata
Claytonia virginica
Hepatica hepatica
Bicuculla canadensis
Chelidonium majus
Syndesmon thalictroides
Asarum canadensis
Capnoides flavulum
Epigaea repens
Aquilegia canadensis.

The sandstone is coarse, and while the exposed summit is very dry and unfavorable to general vegetation, on the slopes, especially where there is an accumulation of talus, coarse and fine mixed together, there is a good cover of vegetation. The finer material gradually weathers to soil, and the spaces between the rocks catch the leaves and debris from the larger plants, to add fertility to the more sandy portion. Percolating moisture supplies and maintains the water supply on the lower slopes, which it cannot conserve on the exposed top.

Summary.

The area of the Upper Midland Province may for convenience in review be divided into (1) Parr's Ridge, (2) the Limestone Valleys, (3) the Sandstone Ridges and (4) the Shale Ridges, and on this basis the points of the discussion may be summarized.

The boundary line between the Upper and the Lower District of the Midland Zone lies in the first Ridge discussed in the foregoing pages, but as Parrs Ridge offers nothing strikingly different in respect to soil and vegetation from the conditions to the east, and in the other portion of the Midland Province of which it is properly the topographic boundary, its bearing upon the Upper Province may be given in a few words.

Parr's Ridge Area.—Along the eastern boundary of the Upper Province the soils are derived to a large degree from the decomposition of the rocks of volcanic or granite types with occasional valleys in limestone. The vegetation which is characteristic of this area is

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FIG. 1.—VIEW SHOWING PURE STAND OF RED CEDAR NEAR CONOCOCHEAGUE CREEK, BROAD FORDING, WASHINGTON COUNTY.

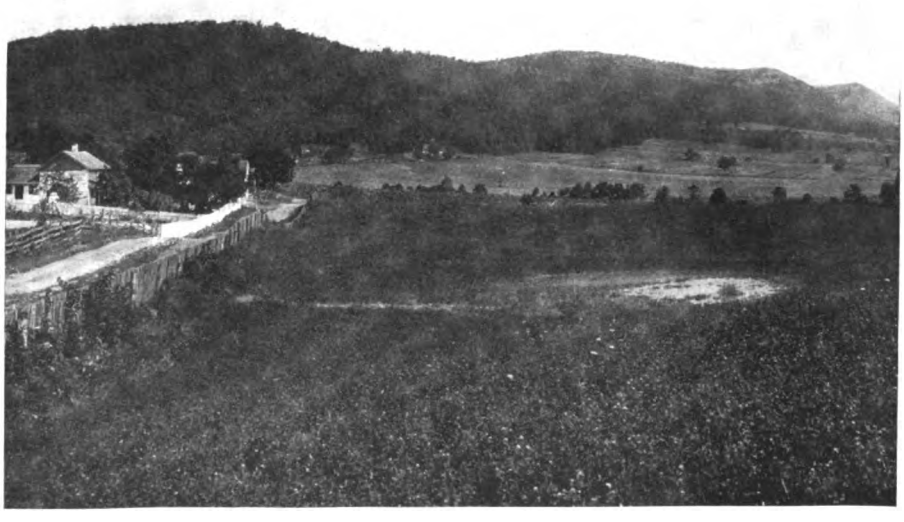

FIG. 2.—VIEW SHOWING THE WESTERN MARGIN OF THE HAGERSTOWN VALLEY, NEAR CLEAR SPRING, WASHINGTON COUNTY.

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one in which the proportion of deep soil and humus plants is high, having a large proportion of Beech in those places where moisture conditions are such as to give the best development of both soil and vegetation. In the less favorable conditions, there is a tendency to produce a type of dry forest, typified in the Chestnut and Rock Oak forest, with a border growth of the Bear Oak. The first type is developed on the lower slopes, and bottoms of the many narrow valleys, or broader drainage slopes of the ridges, the latter is formed along the crests and upper portions of the valley sides, where there is but little moisture in the way of issuing springs, or soil water, and where the drying influence of wind and sun reaches its maximum in the case of forest growth. The undergrowth is of a type similar to that in the ridges of the Lower Province, and needs no special mention. The roadsides are bordered with a turf of pasture grasses in many places, but in the localities of steep or rocky exposures there is little in the way of wild plants beyond the common country weeds to retain the soil, or to interest the traveller in the wayside vegetation.

Frederick Valley.—This is perhaps better called the Monocacy Valley; it includes the broad area of gentle ridges and shallow depressions between the elevation of Parrs Ridge on the east, and that of Catoctin Mountain on the west. It contains in the way of soil characters, a wider variety than the preceding section, but on account of the extensive cultivation the region receives, it is less available for botanical study than the more wooded parts. Where there is forest cover present it is usually composed of nearly the same type of growth as before, but there is a larger quantity of Laurel in the undergrowth, and in the more moist places more of the Ash in the forest.

The value of the land for agricultural uses has made the clearing of it extensive, and there are not many areas of considerable size except in steep and inaccessible places, where the forest remains. The best areas of woodland are in the upper portion of the Valley, and here the composition is hardly different from that of the Parrs Ridge area. The roadside vegetation is almost a constant turf, largely of blue-grass, escaped from the adjacent agricultural land,

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but this is lacking in many places where the farms are scattered, and in woodland areas. There the finer kinds of the woodland grasses and sedges replace the blue-grass, and maintain a covered surface on the more level roadside. The other plants of the wayside are, to a considerable degree, the weeds which are distributed by the farmers in the course of their regular work of transportation of hay, or grain, and thus are most abundant near the more travelled roads, but actually growing in spots where there is not so great traffic or vigilance to keep them under control. In its characteristics the lower portion of the Monocacy Valley becomes a continuation of the larger one to the west, the Hagerstown Valley (Cumberland Valley).

Hagerstown Valley.—The limestone rock which once occupied the region where this depression is now located has by its disintegration and solution, left a soil of such composition that the agricultural uses are paramount, and but little has been left in forest. The wood lots where present are noteworthy on account of the large amount of the Black Locust present, and this tree is so well adapted to the highly calcareous soil that it is the common roadside tree throughout both this and the Monocacy limestone region. The turf of the road margins is better developed in this valley, as the conditions are more uniform. The forest when present is of Chestnut, Hickory, White Oak and the two Walnuts (*Juglans nigra* and *Juglans cinerea*). The slopes of the hills are not gullied by small washes as is the case in the next area, and are more gentle than those of the Parrs Ridge area. The general attitude is a nearly level one, enough slope existing for drainage, but not enough to make it a hilly country.

Some areas of considerable extent have limestone outcrops so frequent as to exclude farm operations. Tree growth is usually good, however, and in considerable variety.

Sandstone Ridges.—The Blue Ridge, including the Catoctin and Elk Ridges, is the eastern one of this division, and owes its present height to the strata of sandstone at the crest. The slopes are usually moist and well covered with a mixed forest, including the better Oaks, Hickory, and Walnuts, with occasional Beeches, in general becoming poorer toward the top.

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The undergrowth is good and includes the forms common to the deep woodland of the Piedmont region, occasional orchids, vernal herbs of the Blood-root, and Hepatica types, mid-season plants like *Porteranthus* and *Rubus* and later vegetation like the Blazing-Star and Hawk-weed. The higher slopes and the summits are much dryer, and after fires may become much modified from the forest type of the uninjured areas. The normal areas produce the Rock Oak, Chestnut, Red Oak, and Scrub Pine, with a border growth of Bear Oak in much abundance, and occasional bushes of Chinquapin. In the depressions in the sandstone small areas of boggy ground are met with, which have a flora of the sandy bog type—Sundew, Peat-moss, and Bog Orchids, etc. The burned areas are covered with a scrub growth of the Bear Oak, Laurel, Brake, and Sweet Fern, relieved by scattered Scrub Pines, and Sassafras. Sugar Loaf Mountain is included here. Scrub Pine is an important element in reforestations of shale lands. Sideling Hill, Round Top, and Wills Mountain, and to a less degree the top of North Mountain, form the other sandstone exposures in the shape of ridges. In the latter, however, the exposure is not so extensive as in the others, and has less influence upon the vegetation. The best example of this group is the Wills Mountain ridge, where there is a considerable difference in the fertility of the adjacent soils, and a higher degree of steep exposure of the sandstone stratum. On the broken slopes the forest is not so greatly changed, but on the dry surface of the sandstone layers, there is a considerable increase in the amount of Scrub Pine, and decrease in the more useful timber trees. Chestnut Oak or Rock Oak, and the Black Locust are prominent among the forest cover, and of the vernal plants, *Mertensia* and *Dodocatheon* are to be found, with the *Bicuculla cucullaria* and *Bicuculla eximia* in the deeper and more moist soils. The later plants are very largely of Goldenrods in mixed profusion, but mainly of the more common varieties.

Shale Ridges.—These are found between North Mountain and Wills Mountain forming most of the lower, steep-sided and much gullied ridges. They are usually covered with a somewhat poor type of forest, the soils being too dry, and lacking in humus to

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become deep or retentive of moisture. The forests comprise two groups, according to the drainage conditions: (1) That on steep slopes, dominated by Pitch Pine and Chestnut Oak, with an abundant undergrowth of such dry ground vegetation as the Wild Indigo. (2) That of more gentle slopes, the White Oak becomes prominent, and the soil deeper and more valuable for all purposes. These soils wash badly, and are on this account best in their natural condition of forest. When the trees have been removed the poor quality of the soil for farming purposes brings it back to a condition for reforesting in a few years.

The conditions of plant growth and distribution in the Upper Province of the Midland Zone are less different in the several natural divisions into which the topography divides the region than might have been expected. This uniformity seems to be produced by the repetition of the same general conditions at intervals within the area, and to the comparatively slight change in elevation and rainfall between the eastern and the western members of similar types of soil or topographic conditions. Thus the valleys rise from 190 feet above tide at the mouth of the Monocacy, near the eastern limit of the district to 610 feet at the mouth of Wills Creek, close to its western limit, a rise of only 420 feet in the 148 miles or about the same difference as that between the Gunpowder River at Loch Raven (near the dam), and the head of Beaverdam Run on the east slope of Chestnut Ridge, west of Cockeysville, a distance of a dozen miles.

The differences in elevation between the bounding ridges is of the same gentle character, Parr's Ridge, at Westminster, being about 1000 feet above tide, and Wills Mountain 1690 feet above the bed of Wills Creek, near Cumberland, a difference of about 700 feet in the distance between the limits of the area considered. When similar soil or topographic conditions are repeated within the limits of so small variations, there is not a great deal of change needed on the part of the vegetation to keep pace with any differences that may locally modify the general type of habitat. The presence of a spring may produce more difference in the space of a dozen rods about its opening, than the broader conditions give in the greater area included in this discussion.

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THE ECOLOGICAL PLANT GEOGRAPHY OF MARYLAND, MOUNTAIN ZONE

BY

FORREST SHREVE

Introductory.

The Mountain Zone has not nearly so great a diversity of vegetation as the Coastal Zone, having borne in its virgin state a continuous covering of forest without meadows or bogs, and without cliffs or extensive rock out-crops. The several types of forest occurring in the Mountain Zone are, however, more distinct from each other than those of any other part of the state, and three of them are chiefly made up of tree species which are either absent or much less common in the Midland Zone. The floristic distinctness of the Zone lies both in the presence of species not found in the remainder of the state, and in the absence of species found throughout the other Zones. The former species, which are listed in Part II, are,—as there pointed out,—either plants of wide range in the north which extend south along the Alleghanies, or are confined to the Alleghanies. The number of Alleghanian species reported from both Pennsylvania and Virginia, but not collected in Maryland indicates that the list of 27 species given may be considerably extended by further search in Garrett County, particularly along the highest mountain ridges. It has not been possible to explore all parts of the Zone at all seasons of the year with sufficient thoroughness to prepare a reasonably complete list of the Coastal and Midland species which are absent. The list given in Part II is therefore chiefly made up of trees.

Many of the species involved in the distinctiveness of the Mountain Zone are common and characteristic in their respective habitats or of very striking appearance, a good number of them, indeed, being forest trees. Among the more notable of these are the Tamarack (*Larix laricina*), the Black Spruce (*Picea mariana*), the Striped

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Maple (*Acer pennsylvanicum*), the Mountain Ash (*Sorbus americana*), the Yew (*Taxus minor*), the Flame Azalea (*Azalea lutea*), the Hobble-bush (*Viburnum alnifolium*), and others. Among the species of the Midland Zone which are absent are several trees abundant in flood plains and on the banks of streams, as the Buttonwood (*Platanus occidentalis*), the Silver Maple (*Acer saccharinum*), the American Elm (*Ulmus americana*) and others.

A few small tracts of virgin forest have been spared in the Mountain Zone, and so recent has been the clearing of the larger areas that something may be learned by hearsay of the character and composition of their stands of merchantable trees. Even in the present condition of the forests it is possible to detect differences in occurrence and distribution of the tree species due primarily to the topographic factors, and in a less degree to the influence of soil texture.

Curran* has investigated the forests of Garrett County, and recognized four major types of forest, the Ridge, Slope culled and cut-over and Swamp types, the distribution of which he has indicated by means of a map. The Ridge and Swamp types are designated here by the same names, the Slope type is distinguished as the Rocky Slope type.

Of the seven forest types which will be described in this paper the one which would be considered the highest from the standpoint of physiographic ecology is that which occupies the lower slopes of the main mountain ridges and the smaller hills. It is found throughout the district and in the virgin state of the country was one of the commonest types. The presence of a deep soil with an abundant accumulation of humus material, added to conditions of soil moisture which approach the optimum for forest trees, makes the Slope habitat rich in tree species, all of which are deciduous, and particularly rich in its herbaceous flora.

The Ridges are much poorer in species of trees and in herbaceous vegetation than the Slopes, having a stand made up chiefly of the Chestnut (*Castanea dentata*) and Chestnut Oak (*Quercus prinus*). The type reaches its greatest distinctness on the summits of Big Savage, Great Backbone and Meadow mountains. The writer has

*Curran, H. M. The Forests of Garrett County. Maryland Geological Survey, Garrett County, 1904, pp. 303-329.

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been told that there was little difference between the virgin forest of the slopes and ridges of the larger mountains. This may have been true of the extreme ridges when compared with the upper slopes, but cannot have been true of the ridges and the middle and lower slopes.

Over the gently rolling plateau which extends north-easterly and south-westerly from Oakland and over the more level portions of the north-western corner of Garrett County there are two types of forest which are not greatly different as respects their tree species but which are unlike in their herbaceous floras, the types which respectively occupy the Loams and the Sands. Neither of these is known to the writer in the virgin state, indeed they occupy the areas which have been most thoroughly lumbered and most encroached upon by the clearing of farming lands. The loam forest is deciduous, being chiefly made up of White Oak and Black Oak. The forest of the Sands is made up of White Oak, other oaks and a considerable percentage of Pitch Pine, and is found overlying the sandstones of the Allegheny, Conemaugh, and Pottsville formations.

On the steep lower slopes of mountains where the soil is thin or occurs only in pockets in the rocks, and also along the rocky banks of rivers is found a coniferous type of forest in which the Hemlock is the predominant tree. In some localities these Rocky Slopes and the soil-covered Slopes merge into each other, giving a mixed deciduous and coniferous forest, as at several localities along the Castleman River.

In the deep soils of the bottoms of broad valleys and on flood-plains there were formerly pure stands of White Pine, occupying situations which are locally known as "Glades." One of these forests situated about half way between Frostburg and Grantsville was traversed by the National Road and was known to the early settlers, by reason of the dense shade, as "The Shades of Death." Although no pure stands of virgin White Pine are left, the writer has seen a small tract of White Pine and Black Spruce in which the herbaceous and other subordinate vegetation was identical with that on the Rocky Slopes.

In the mountain Swamps there is a coniferous type of forest made up chiefly of Black Spruce, with some Hemlock and, in two localities, the Tamarack as well. There was formerly an extensive area

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of Swamp forest four miles north-east of Thayerville, and small tracts of it have been examined by the writer at Thayerville, Cranesville and near Finzel. A large number of boreal species of herbaceous plants which find their southern limit in Maryland or Virginia occur only in or about the Swamps and the Bogs which now occupy some of the cleared Swamp areas.

The only cultural habitats of ecological interest are the cleared bottom lands, or Meadows, formerly occupied by "Glade" forest, which now, if uncultivated for several years, bear a rich and varied stand of sun-loving palustrine plants.

Slopes.

The forest typical of Slopes has been examined at Swanton, Kelso Gap and Conway Hill on Great Backbone Mountain; west of Frostburg and west of Midlothian on Big Savage Mountain; and at Roman Nose Mountain, five miles north of Oakland.

Lumbermen state that the White Oak was the predominant tree of the virgin forest of the Slopes, where it reached a maximum height of 125 to 150 feet, giving clean trunks 100 feet long. This height was undoubtedly attained by many of the subordinate trees, although there are now no second growth stands in which the height of the forest canopy exceeds 75 feet. The White Oak is still the commonest tree, occurring in varying percentages, but nowhere forming as much as half the stand. The commonest subordinate species, which are about equally abundant, are the Linden, the Cucumber Tree, the Sugar Maple, the Sweet Birch, the Red Oak, and the Shagbark Hickory. The abundance of these six species is one of the principal characteristics of the forests of the Slopes, for no one of them is so common in any other habitat in the state. Much less frequent than the preceding are the Butternut, the Scarlet Oak, the Chestnut Oak, the Chestnut, the Wild Black Cherry and the Pignut Hickory. The Butternut is not so common here as in similar forests in the Upper Midland, and the Chestnut Oak and Chestnut are much more abundant on the ridges. The absence of the Tulip Tree (*Liriodendron tulipifera*), which is rare in the Mountain Zone, is particularly notable, as it is found abundantly in just such habitats in the Mid-

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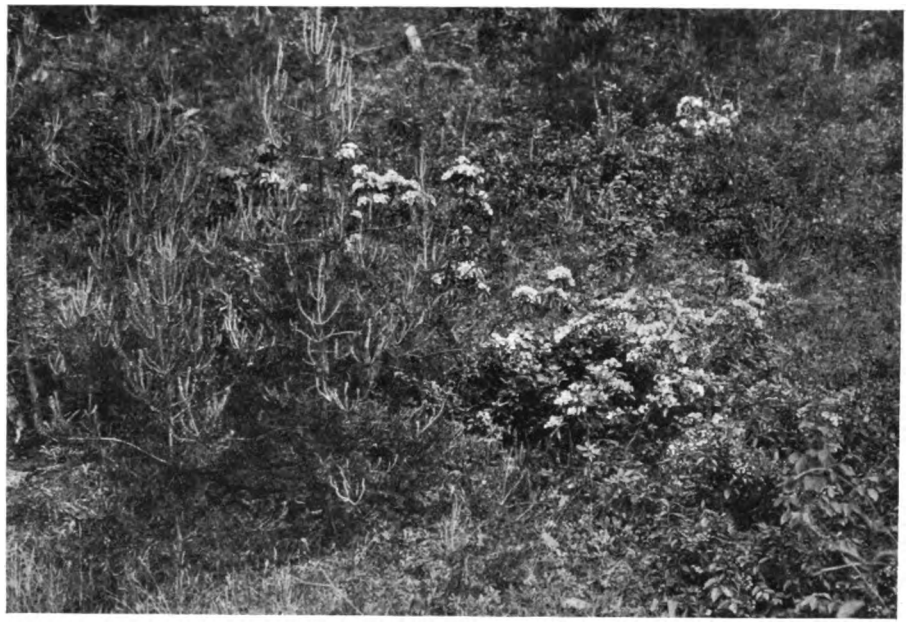

FIG. 1.—VIEW SHOWING VEGETATION OF CUT-OVER SLOPES ON THIN SHALE SOIL WITH LAUREL AND SEEDLING PINES, NEAR HANCOCK, WASHINGTON COUNTY.

FIG. 2.—VIEW SHOWING ROADSIDE VEGETATION ON SHALE SOIL WITH SUMAC, GRAPE, RUBUS, LACTUCA AND DICKSONIA, NEAR HANCOCK, WASHINGTON COUNTY.

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land Zone. Coniferous trees are absent except where the thin soil of lower slopes favors the occurrence of occasional individuals of the Hemlock. The tree species of subordinate importance are the Striped Maple, the Beech, the Sassafras, the Hornbeam, the Mountain Maple, the Black Oak and the Serviceberry. The most frequent shrubs in the Slope forests are:

Hamamelis virginiana
Hydrangea arborescens
Vaccinium vacillans
Cornus alternifolia
Viburnum acerifolium
Spiraea corymbosa
Diervilla diervilla
Rhododendron maximum
Ribes rotundifolium.

The absence of the Flowering Dogwood from the Mountain Zone is particularly noticeable in this habitat; its place in the physiognomy of the vegetation being taken by *Cornus alternifolia,* which is infre quent in the Midland Zone. The shrubs are scattering in the midst of the forest, but abundant in openings and along the margins.

The floor of the forest occupying deep-soiled Slopes is extremely rich in herbaceous plants, both in individuals and species,—indeed there is no habitat in the state, of any character, which has a larger flora. Several of the species of herbaceous plants peculiar to the Mountain Zone are found here, and a much larger number which occur very rarely in the Soil-covered Slopes of the Lower Midland District are abundant or common. The only species which are conspicuously abundant as compared with others are *Osmunda claytoniana* and *Dryopteris spinulosa* var. *intermedia.* As one moves from place to place in the forest the impression is given that an exact census of several small areas would give about the same figures in each case for the relative abundance of the following species:

Hydrophyllum virginicum
Arisaema triphyllum
Trillium erectum
Washingtonia longistylis

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Geranium maculatum
Aster divaricatus
Disporum lanuginosum
Adiantum pedatum
Brachyelytrum erectum
Uvularia sessilifolia
Cypripedium parviflorum
Medeola virginiana
Aster cordifolius
Eupatorium ageratoides
Galium lanceolatum
Unifolium canadense
Hepatica triloba
Podophyllum peltatum
Dryopteris marginalis
Adicea pumila
Syndesmon thalictroides
Peramium pubescens
Campanula americana
Botrychium virginianum
Parthenocissus quinquefolia
Silene stellata
Aquilegia canadensis
Cimicifuga racemosa
Juncoides campestre
Phryma leptostachya
Monarda punctata
Phegopteris dryopteris
Geum canadense
Urticastrum divaricatum
Dioscorea villosa
Asplenium filix-foemina
Circaea lutetiana
Mitella diphylla
Washingtonia claytoni
Actaea alba
Collinsonia canadensis

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Viola canadensis
Anemone virginiana
Falcata comosa.

Less abundant than the above and more sporadic in their occurrence are the following:

Solidago monticola
Carex platyphylla
Caulophyllum thalictroides
Smilacina racemosa
Aralia nudicaulis
Asarum canadense
Erythronium americanum
Oxalis acetosella
Polemonium reptans
Streptopus roseus
Bicuculla canadensis
Jeffersonia diphylla
Dentaria diphylla
Sanicula gregaria
Thalesia uniflora
Cypripedium pubescens
Cypripedium parviflorum
Panax quinquefolium
Asclepias quadrifolia
Trillium undulatum
Conopholis americana.

Around springs and along small streams are to be found a number of herbaceous plants, some of which do not occur elsewhere in the Slope forest, a few of which are not known elsewhere in the State. The most common of these are *Urticastrum divaricatum, Adicea pumila, Impatiens biflora* and *Chelone glabra.* One of the most showy plants of the Mountain Zone, *Monarda didyma,* is found only in this habitat, its brilliant scarlet flowers being very striking amid the sombre surroundings. Other characteristic species are *Caltha palustris, Saxifraga pennsylvanica, Saxifraga micranthidifolia.*

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Trautvetteria carolinensis, Arabis canadensis and *Cimicifuga americana.* The last of these is an uncommon Alleghanian species closely resembling the frequent and wide-spread *Cimicifuga racemosa.*

Ridges.

The Ridge type of forest has been seen by the writer at several localities along the summit of Great Backbone Mountain and Big Savage Mountain in Garrett County, and on the summit of Piney Mountain in Allegany County. The type is described by Curran and is indicated on his map of the forest types of the county as extending also along the summits of Negro and Meadow mountains.

This habitat is poor in tree species, being made up predominantly of Chestnut, Chestnut Oak, and Red Oak, which together form 75% to 90% of the stand of the second growth forests which now alone represent the Ridge type. The trees of secondary abundance are the White Oak, Shagbark Hickory, Black Oak, Sweet Birch, Sassafras, Cucumber Tree and Linden,—the last two of which are uncommon. There is no sharp line of demarcation between the Ridge and Slope types, the former passes gradually into the latter on the upper slopes of the mountains, as may be seen in descending the road which leads from the summit of Backbone Mountain down to Swanton. The Ridge forest recalls strikingly the forests of the gravel hills of the Lower Midland District, both in the abundance of the Chestnut and Chestnut Oak, and in the herbaceous vegetation. On Piney Mountain this resemblance is more close than on the mountains of Garrett County, due to the almost pure stand of the two trees mentioned. The shrubs characteristic of the Ridge forest are: *Vaccinium stamineum, Gaylussacia resinosa, Vaccinium vacillans, Ribes cynosbati* and *Crataegus punctata. Kalmia latifolia,* which is so abundant in the Gravel forests, is uncommon on the Ridges of the Mountain Zone, preferring the Rocky Slope forests.

Among the most common herbaceous plants may be mentioned:

Eupatorium ageratoides
Aster sagittifolius
Potentilla canadensis
Veronica officinalis

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Eatonia nitida
Gaultheria procumbens
Galium lanceolatum
Lacinaria scariosa
Doellingeria umbellata
Geranium maculatum
Aralia nudicaulis
Silene stellata
Porteranthus trifoliatus
Lysimachia quadrifolia
Hedeoma pulegioides
Pteris aquilina
Pedicularis canadensis
Aralia racemosa
Panicum capillare
Solidago bicolor
Angelica villosa
Hieracium paniculatum
Washingtonia longistylis
Dasystoma laevigata
Asclepias quadrifolia
Pogonia verticillata
Polygala verticillata
Hieracium venosum.

At many places along the summit of Great Backbone Mountain the soil overlying the sandstone rock is thin, and at other places rock outcrops and gigantic boulders completely occupy the surface. On the boulders and in their crevices grow stunted trees of Sweet Birch and Mountain Ash. Such a habitat for Mountain Ash is particularly surprising as the tree is elsewhere in the Zone found only in the Glade and Swamp forests. Equally striking here is the occurrence of *Impatiens aurea* commonly found only in flood plains and meadows, and nowhere so common in the Mountain Zone as it is in the Midland. It is probable that the porous sandstone boulders serve as reservoirs of water which is fed out into the crevices, thus favoring the occurrence of hygrophilous plants in a habitat which would ap-

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pear to be hostile to them. Growing rooted in mosses on top of the boulders or in their crevices is found *Capnoides sempervirens,* which occurs only in just such situations here, and in the Blue Ridge and in Baltimore County, near Warren. Other plants common on or among the boulders are:

Sambucus pubens
Hamamelis virginiana
Hydrangea arborescens
Acer spicatum
Ribes cynosbati
Rubus odoratus
Aster acuminatus
Tiarella cordifolia
Polypodium vulgare
Umbilicaria sp.

Valleys.

Loams.—The vegetation of the loam soils of the central valley of the Garrett County plateau is known to the writer only from an examination of cut-over forests in the vicinity of Oakland, where the White Oak is the predominant tree, forming 75% to 90% of the stand. In the virgin forests of the loam soils there was doubtless a larger percentage of the species which are now subordinate: i. e. the Red Oak, the Black Oak, the Shagbark Hickory, the Chestnut, the Pignut Hickory, the Scarlet Oak, the Red Maple, the Sweet Birch and the Hornbeam.

The shrubby vegetation is predominantly made up of *Quercus nana* and *Vaccinium stamineum,* together with *Gaylussacia dumosa, Corylus americana, Cornus candidissima, Rhus copallina* and *Crataegus uniflora.* In the most open cut-over stands the herbaceous plants are almost identical with those of the Ridges. In the older second growth stands, such as those in the vicinity of Deer Park may be seen:

Solidago bicolor
Pedicularis canadensis
Nabalus albus

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Dasystoma laevigata
Angelica villosa
Aster sagittifolius
Hieracium scabrum
Antennaria plantaginifolia
Potentilla canadensis
Geranium maculatum
Aralia nudicaulis
Doellingeria umbellata
Hieracium paniculatum
Andropogon furcatus
Aster laevis
Uvularia perfoliata
Dasystoma virginica
Zizia cordata
Melampyrum americanum
Smilax hispida
Gyrostachys cernua
Gentiana andrewsii
Chrysopogon avenaceus
Dioscorea villosa
Aralia racemosa
Hystrix hystrix
Castilleja coccinea
Senecio balsamitae
Chamaelirium luteum
Lycopodium complanatum
Aster concinnus
Pyrola elliptica
Houstonia coerulea
Pimpinella integerrima
Asclepias quadrifolia
Helianthus divaricatus
Apocynum androsaemifolium
Lobelia spicata
Kneiffia pumila
Washingtonia longistylis
Achroanthes monophylla.

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SANDS.—The forest of the Sands has been studied chiefly in the portion of Garrett County lying west of the Youghiogheny River. Like the Loam type it now exists only in the cut-over condition, in which it is not so distinct from the Loam forests in its tree species as it is in its herbaceous flora, which comprises many of the plants common on sandy soils in the Coastal Zone. The soil is deep but full of sandstone boulders. The same deciduous species occur as in the Loam forest, with White Oak predominant; and Pitch Pine, forming a small percentage of the stand, is distinctly characteristic of the type. Along streams in the Plateau Sand forests Black Gum, Red Maple and Winter-berry are more common than elsewhere in the Mountain Zone, recalling the Stream Swamps of the Eastern Shore.

The shrubby vegetation is likewise quite similar to that of the Loam forests, having in addition: *Aronia arbutifolia, Viburnum dentatum, Salix tristis, Comptonia peregrina.*

The herbaceous vegetation of this type embraces:

Gaultheria procumbens
Mitchella repens
Pteris aquilina
Andropogon furcatus
Baptisia tinctoria
Hieracium scabrum
Meibomia nudiflora
Koellia flexuosa
Sarothra gentianoides
Aster ericoides
Lupinus perennis
Cracca virginiana
Epigaea repens
Ionactis linariifolius
Lespedeza hirta
Aster sagittifolius
Polygala verticillata
Sisyrinchium graminoides
Hieracium paniculatum

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Comandra umbellata
Hypoxis hirsuta
Habenaria ciliaris
Cypripedium acaule
Dicksonia punctilobula
Juncus dichotomus
Polygala viridescens
Rynchospora glomerata.

Rocky Slopes.

The Rocky Slope type of forest occurs throughout the Mountain Zone in tracts of limited size. It has been examined in its virgin state at Boiling Spring and Swallow Falls. It formerly existed along the banks of the Youghiogheny, Castleman and Savage rivers and in isolated groves at the heads of smaller tributary streams. The dominant tree is the Hemlock, which forms 75% to 90% of the stand. The circumstances under which the lumbering of the orginal tracts took place has rendered the conditions extremely unfavorable for the reseeding of Hemlock, and the writer does not recall having seen any second growth forest of this type. The principal deciduous species in the forest are Yellow Birch, Red Maple and Sugar Maple. Relatively infrequent are the Beech, the White Oak, the Butter-nut, the Linden and the Yellow Birch.

In some parts of the Rocky Slope forests, particularly along streams, the undergrowth of *Rhododendron maximum* forms dense thickets which are very difficult to penetrate, in other places the floor of the forest is almost clear of shrubs and carpeted by small herbaceous plants, mosses and hepatics. In addition to *Rhododendron, Kalmia latifolia* is abundant. *Viburnum alnifolium,* a striking shrub with large leaves resembling those of the Linden, is frequent in these forests but not found elsewhere in the state. *Sambucus pubens* is also frequent, and in pockets of deep soil the prostrate shrub *Taxus minor* is not uncommon, resembling the Hemlock very strongly in the appearance of its foliage. Less frequent are *Menziesia pilosa, Diervilla diervilla* and *Lonicera ciliata.*

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While the herbaceous vegetation is not rich in species it is extremely so in individuals. *Oxalis acetosella* and *Mitchella repens* may form a continuous carpet for many square yards. *Dalibarda repens, Unifolium canadense* and *Circaea alpina* are also gregarious and extremely abundant. Other characteristic species are *Dryopteris spinulosa* var. *intermedia, Phegopteris phegopteris, Aster divaricatus, Heuchera pubescens, Rubus hispidus, Waldsteina fragarioides, Trillium erectum, Actaea alba,* and *Lycopodium lucidulum.* Infrequent in the Rocky Slope forests, but not known outside them in the state are *Habenaria bracteata, Habenaria orbiculata* and *Hepatica acuta.* The fallen logs and open places in the forest floor are closely covered with the mosses *Thuidium, Mnium* and *Bryum,* with the hepatics *Bazzania* and *Scapania* or the lichen *Peltigera.*

Glades.

The Glade type of forest was a nearly pure stand of White Pine, with a small admixture of Black Spruce, Yellow Birch, Wild Black Cherry and Mountain Ash. The dense shade of the floor made the shrubby vegetation scant, while the herbaceous plants appear to have been much the same as those already mentioned as being characteristic of the forests of Rocky Slopes. In the small areas of Glade examined the following herbs were noted:

Oxalis acetosella
Mitchella repens
Panicularia nervata
Osmunda claytoniana
Rubus hispidus
Vagnera racemosa
Unifolium canadense
Viola cucullata
Carex hystricina
Dalibarda repens
Caltha palustris
Dryopteris spinulosa.

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Swamps.

The Swamp type of forest has been examined at Wolf Gap, near Finzel, at Thayerville and Cranesville, at each of which localities there are small groves of virgin or old second growth trees. The Swamp forest is distinctly coniferous, with the Black Spruce the predominant tree and the White Pine, the Hemlock and Tamarack the principal secondary species. The Black Spruce forms 60% to 75% of the stand; the Pine and Hemlock together, 15% to 20%; the Tamarack is found at Cranesville and is abundant at Thayerville, but is not known elsewhere in the Zone. The White Spruce (*Picea rubra*) is reported for Garrett County by Curran, but has not been seen there by the writer. The deciduous trees in the Swamps are the Yellow Birch, the Red Maple, the Mountain Ash and the Black Ash.

Among very dense stands of spruce there is little shrubby vegetation, the saturated ground is covered with beds of *Sphagnum, Polytrichum, Thuidium* and *Bazzania,* and there are scattered plants of *Osmunda cinnamomea, Spathyema foetida, Dalibarda repens, Carex folliculata, Osmunda regalis, Unifolium canadense, Viola sagittata, Trillium erectum* and *Habenaria clavellata.* Where streams traverse the swamps or where the stand of trees is more open there are dense thickets of *Rhododendron maximum.* Other abundant shrubs are *Alnus rugosa, Viburnum cassinoides, Aronia nigra, Ilex verticillata, Ilicioides mucronata* and *Benzoin benzoin. Taxus minor* also occurs on moist but not on saturated soil. In the Swamps at Cranesville and Thayerville the following herbaceous plants, in addition to those named above, are common:

Impatiens biflora
Chelone glabra
Chrysosplenium americanum
Veratrum viride
Thalictrum dioicum
Galium triflorum
Panicularia nervata
Eupatorium purpureum

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Rubus hispidus
Dryopteris spinulosa
Dryopteris cristata
Mimulus ringens
Caltha palustris.

The Swamp at Wolf Gap near Finzel is chiefly of second growth and has more deciduous trees in its make-up than the Cranesville and Thayerville Swamps. All of the plants thus far named have been seen at Finzel excepting the Tamarack and *Taxus minor* and *Ilicioides mucronata.* Additional species to those named above are *Aronia atropurpurea, Aster acuminatus, Polemonium reptans, Orontium aquaticum, Caltha flabellifolia, Clintonia borealis.*

Bogs.

The Bogs of the Mountain Zone are all situated near areas of Swamp or Glade forest, or in places where these forests formerly stood. At Finzel, Thayerville and Cranesville there are typical Bogs, and others have been examined between Oakland and Crellin and between Oakland and Deer Park. All of the Bogs bear unmistakable evidence of formerly having been forested, presumably by Spruce and White Pine, and the encroachment upon them of shrubs, chiefly Alders and seedling trees, chiefly Red Maple, indicates that they will rapidly return to forest if undisturbed. In the virgin Swamp forests there were probably narrow belts of Bog along the streams which traversed them, or perhaps around their edges on the transition line between the Swamp and the Upland. The clearing of the Swamps would result in the occupation of the bare floor by a continuous covering of *Sphagnum,* into which the characteristic Bog plants would migrate from the areas already present.

The typical Bogs of the northern United States are usually found around glacial lakes or in depressions formerly occupied by lakes which have been filled by the accumulation of *Sphagnum.* Since the topography of the Mountain Zone presents no such habitat favoring the development of Bogs it is not surprising to find them limited in occurrence and size. The species which are dominant in the northern

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FIG. 1.—VIEW SHOWING SHALE OUTCROP WITH ASPLENIUM AND ASTER, SIDELING HILL. WASHINGTON COUNTY.

FIG. 2.—VIEW SHOWING THE VEGETATION OF THE SANDSTONE SLOPES OF TONOLOWAY RIDGE WITH SCRUB PINE, CHESTNUT, SCRUB OAK AND SWEET FERN, NEAR HANCOCK, WASHINGTON COUNTY.

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Bogs and characteristic of them are far less common, if not absent, south of the glaciated region. But few of these, indeed, are found in the Bogs of the Mountain Zone,—a less number than are found in the bogs of the Western Shore district of the Coastal Zone.

The characteristic species in the Bogs of Garrett County which are also abundant in bogs in the glaciated portion of North America are: *Eriophorum virginicum, Rubus hispidus, Oxycoccus macrocarpus, Drosera rotundifolia, Dryopteris thelypteris, Habenaria clavellata, Triadenum virginicum, Dulichium arundinaceum* and *Osmunda regalis.*

These shrubs characteristics of the Bogs are *Alnus rugosa, Alnus incana, Ilicioides mucronata, Ilex verticillata, Azalea viscosa* and *Hypericum densiflorum.* Other herbaceous species are *Solidago monticola, Gentiana linearis, Scirpus cyperinus, Carex atlantica, Dryopteris cristata, Carex baileyi, Caltha palustris, Hypericum canadense, Dryopteris spinulosa* and *Pogonia ophioglossoides.*

Conclusions.

The floristic history of the Mountain Zone has been similar to that of the Midland. There have been climatic fluctuations since Tertiary time that were of the same amplitude as those to which the Midland District was subjected but their maximal and minimal points were lower. This has resulted in a less invasion of the Mountain Zone by southern forms, and the persistence of numerous northern forms.

Although the main outlines of the topography of the Mountain Zone are old and topographic development has gone on well toward maturity in many localities, yet the elevation and the differential weathering of the underlying rocks has prevented a maturing of the topography of the Zone as a whole. The presence of the great mountain ridges and of the long valleys with horizontal floors has maintained a diversity in the vegetation far greater than that of the Lower Midland District.

In the relatively level valleys the influence of the physical character of the underlying rock is shown through its determination of the character of the soil, while in all other situations topography

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plays a more important role in determining the vegetation, being responsible for the distinctions of Ridge, Slope, Glade and Swamp. The character of the Ridges will not be lost until they are worn well down toward the level of the Valleys, when they will pass through the slope stage to that of the Valleys, when, for the first time in their history, the influence of the subjacent rock will be manifested, sandstone soil supporting the Sand type and shale soil the Loam type. The weathering of the Rocky Slopes and the carrying of erosion materials down onto them will make them approach the soil-covered Slopes in character. The silting up of the Swamps will lead to the invasion of them by Glade forest, which may be in turn invaded by the Valley type, although little evidence of such invasion has been observed.

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PART IV

THE RELATION OF NATURAL VEGETATION TO CROP POSSIBILITIES

BY

FORREST SHREVE

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THE RELATION OF NATURAL VEGETATION TO CROP POSSIBLIITIES

BY

FORREST SHREVE

It was one of the initial purposes of the botanical exploration of Maryland to discover what relations there may be between the spontaneous vegetation of a particular geological or soil formation, or a particular topographic feature, and the agricultural capabilities of the same area. To what extent does the character and composition of a forest or the occurrence of particular tree species give indication of what crops may be expected to succeed upon the land if cleared, or upon nearby land of the same character? What indication is given by the occurrence of particular native or introduced plants, particularly weeds and grasses, as to the capabilities of the land upon which they grow; and when those capabilities are discovered how surely may the relation there existing be taken as a sure indication of the same relation holding elsewhere in the state? It has been said that many of the settlers in early colonial days chose the locations for their homes and cleared the virgin forest in accordance with the promise which the natural vegetation gave of the soil being deep and rich. This is corroborated by the fact that throughout Maryland the oldest and largest holdings of land are the ones that are most responsive to tillage and most productive, while the smaller holdings of the recent settlers occupy land which is stony, sandy, poorly drained or otherwise undersirable. It goes without saying that the uniform and intelligent treament of the large holdings has served to improve the texture of their soils and to prevent the exhaustion of their fertility, but there is much evidence, particularly on the Eastern Shore, that the virgin forest did give indication of the character of the underlying soil and hence its cultural capabilities, and that the practice of the settlers was well grounded. It is also true that at the present day farmers frequently judge the char-

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acter of a piece of land by the weeds growing on it,—the presence of and abundance of the Great Mullein (*Verbascum thapsus*) or Sheep Sorrel (*Rumex acetosella*), for example, being sufficient to condemn a field as poor, or at least in a "run down" condition.

Before entering into an examination of the manner in which the common dependence of spontaneous and cultivated plants upon the external factors of climate and soil may cause a relation between the character of the two, it may be well to review the present condition of the vegetation of the state as compared with that which it originally bore, in order to obtain a proper conception of the comparative validity of the several methods of estimating the cultural value of land.

The occurrence of forest over the state at large is due to those far reaching but fundamental climatic factors, temperature and rainfall, which are of such a character as to favor this highest type of plant formation throughout eastern North America. Only in the grassy marshes bordering the salt estuaries and in the sands of the coastal bars are local conditions of soil so marked and so hostile to tree growth as to give rise in the former case to a grassland and in the latter to a desert-like condition. Cultivaton has replaced the primeval forests with fields and with second and third growths of timber. The difference between a piece of virgin forest and a wood-lot such as may be found on almost every farm, is profound and striking. In the former the largest trees tower to a height of 100 feet or more, trees of smaller stature and less demand for light crowd the space between the larger trees, here the shrubby vegetation is sparse and the forest floor darkened by the dense tree-tops above it, in another spot are impenetrable thickets of Rhododendron, Laurel or Bayberry. On the ground or on the fallen trunks of forest giants are dense carpets of shade-loving herbaceous plants or mosses or hepatics. The neighboring wood lot may contain much the same assemblage of trees and shrubs as the virgin growth, but the stature of the trees is much less and usually the greater openness of the canopy results in a much drier condition of the forest floor with a corresponding alteration in the herbaceous vegetation. The difference between virgin and second growth forests lies, then, not so much in differences in the actual species found in both as in the

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general appearance of the plant assemblage and the relative abundance of the species involved. There are nevertheless a few small plants found only in the shade of deep forests which seem to be disappearing as the virgin forests are destroyed, notably the Small Enchanter's Nightshade (*Circaea alpina*) and the Twin Flower (*Linnaea borealis*). On the other hand the clearing and cultivation of the country with all its attendant activities has brought about the introduction from Europe, South America, our Western States and elsewhere of a very large number of plants, most of which have become a permanent part of our flora. These introduced plants belong chiefly, though not entirely, to the class which we designate as weeds, and owe their introduction and persistence to a high faculty of withstanding adverse conditions of soil moisture and to a high degree of adaptability to varying external conditions. As these introduced members of our flora have found their way here they have taken up as habitats the fields and other cultivated grounds, roadsides and waste places, so that the plant assemblages which they form are separate from the assemblages of native plants, whether or not these are modified by man. It is very necessary in the study of a highly cultivated area like Maryland to keep in view the modifications in the plant-life due to man. The number of species actually exterminated are few if any; the number introduced is large but we know just which ones they are and,—with a few exceptions,—they are distributed throughout the state. So far as concerns the flora of the state, then, cultivation has made no change save a considerable addition of species. As concerns the vegetation of the state, however, the changes have been profound.

The attempt has been made in the foregoing chapters to give some notion of the character of the original vegetation of the various parts of the state, so far as that may be reconstructed from the plant covering of today. The observation and study of vegetation has centered about virgin and other old growths of forest, swamps, marshes, bogs, dunes and beaches, because it is only in such habitats that one may find native plants in their natural relation to external conditions and to each other. Inasmuch as every plant which is growing and reproducing has necessarily found conditions which are more or less congenial to it, no matter by what means it came to be grow-

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ing in that spot or in what relation it stands to the plants with which it is associated, it would appear at first thought that the introduced weeds are quite as good indicators of the conditions of soil or climate under which they are persisting as are the native species. This is a matter in which both native and introduced plants vary among themselves, but in general it may be said that the great bulk of native plants are capable of survival only in much narrower ranges of conditions than are the introduced ones which have become weeds.

An inquiry into the relation between spontaneous and cultivated vegetation may well follow several lines of procedure. To what extent, it may be asked, do the ranges of occurrence of native species indicate the regions in which particular crops may be successfully planted; to what extent does the composition of the forest give indications; to what extent the occurrence of particular tree species in the forests; and, as well, to what extent may the occurrence of particular weeds or other herbaceous plants serve the same end.

Correspondences have frequently been pointed out between the natural range of a plant species and the area within which a particular crop may be successfully planted. For example, I have been told by Dr. Roland M. Harper that in the southern states there is a close correspondence between the distribution of the Loblolly Pine and that of the profitable cultivation of cotton, and in Maryland the region in which the Red Spruce is native is adapted to the successful cultivation of buckwheat. These are cases in which it is the length of growing season and the temperature requirements of the correlated species that is significant. Merriam has pointed out* the various life zones of the United States, based upon the collective ranges of characteristic plants and animals, and has shown that these may furnish a basis for recommendations as to the probable success of various cereals, vegetables and fruits within the zones. This class of phenomena is quite a special case in the relation of natural and cultivated plant life, and can give only the most general indications with regard to the suitability of the atmospheric factors affecting plants. Indeed, it often happens, as in the case of the

*Merriam, C. Hart. Life Zones and Crop Zones of the United States.

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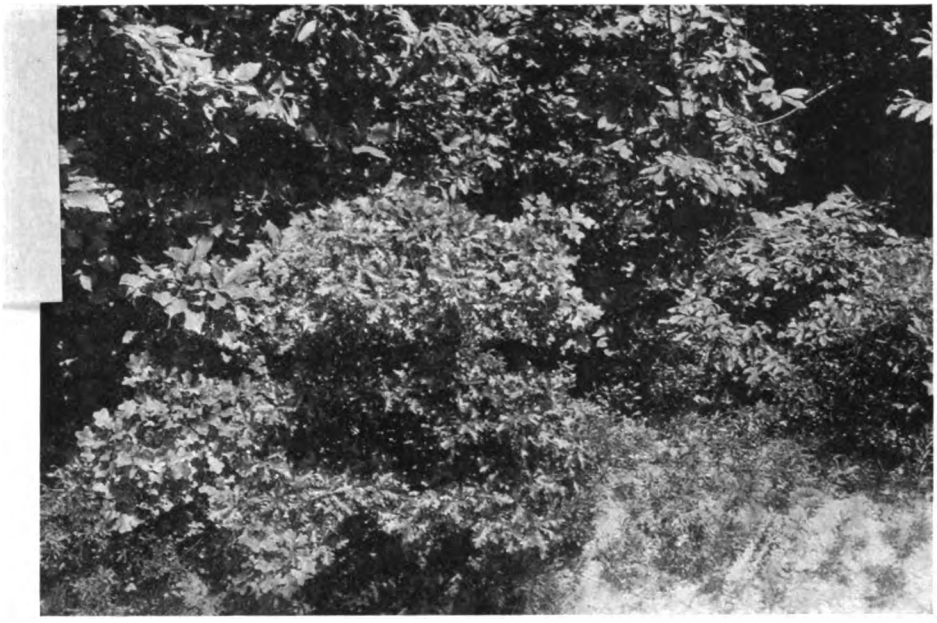

FIG. 1.—VIEW SHOWING FOREST BORDER WITH SCRUB OAK, CHINQUAPIN OAK AND SWEET FERN, NEAR WESTMINSTER, CARROLL COUNTY.

FIG. 2.—VIEW SHOWING THE COMMON POLYPODY AMONG SANDSTONE BOULDERS, WILLS MOUNTAIN, ALLEGANY COUNTY.

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Spruce and the Buckwheat, that the soil requirements of the two correlated species are quite distinct.

The other inquiries mentioned above may be made as respects the vegetation of smaller areas with uniform climate, when the matter of topography and soils becomes the centre of interest. The composition of forests is of particular value in indicating the character of soils because it represents the degree to which the component species find their optimum requirements. It is, in other words, a special case of the indicating value of individual species, in which natural competition has served to bring forth into predominance the species to which the conditions are most nearly suited.

The greatest obstacle to using forest composition as an index of agricultural capabilities is one that also hindered the gathering of an adequate idea of the original forest covering of the various portions of the state, namely marked difference between nearby forests under identical external conditions. The conditions under which each particular piece of woodland was cleared and under which it has returned to forest have a great and a varying influence on its make-up. Particularly in the Lower Midland District on the Cecil loam and the Cecil mica loam do the forests vary in composition to an extreme degree. Elsewhere, as in Worcester County, the same type of forest may be found on a number of the different soil types recognized. Indeed, a comparison of the soil map of Worcester County with the carefully prepared forest map will show at a glance that there is no sharp relation between the soils and the forest types. It is true, however, that many soils which are mapped as distinct are differentiated on characters that are of no importance in the physiology of the plant, as for example, the Cecil loam and the Cecil mica loam, the Sassafras sandy loam and the Portsmouth sandy loam. In the case of soils of more marked character there are, however, obvious differences in the plant covering, as occurs in the Lower Midland District between Cecil loam and Susquehanna gravel, or either of these soils and the Conowingo clay, or between Norfolk sand and Elkton clay. The physiography of an area is of determining influence upon the plant covering through its fundamental relation to soil water supply, and this fact offsets many influences of soil composition, as may be noted in the difference between the

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forest of the summits of the gravel hills of the Lower Midland District and their bases (see p. 217), or in the identity of forests in like topographic situations on Cecil loam or on Cecil clay in the same District (see p. 202). And again, widely distinct soils in different localities may display the same plant covering. On the Susquehanna gravel of Cecil County and on the loams derived from Devonian shales on Piney Mountain in Allegany County may be seen identical forests of Chestnut and Chestnut Oak, with the same accompanying shrubby and herbaceous vegetation. It appears then that forest types do vary with the underlying soils when these are of marked character, but that they also do not fail in many cases to be uniform over different soils, and to vary on the same soil. In how far these results are due to the forest areas examined being almost exclusively second and third growths cannot be determined.

There are certain trees the presence or absence of which may be taken as valuable evidence in judging soils, even in the present disturbed condition of the forests of Maryland. Several classes of soils which are thin, rocky or gravelly and several classes of topographic situations in which the conditions are equivalent are found to abound in the Chestnut Oak, the Post Oak, the Black Jack Oak and the Scarlet Oak. The predominance of any one or two of these trees, for they rarely all occur together, may be taken as a clear indication that the soil is not suited for any of the usual farm crops, although a few fields of buckwheat have been seen on such soils, and near such forest stands in the Mountain Zone. In similar fashion the occurrence of the Swamp Oak may be taken as a sure indication of poorly drained and sour soil, demanding underdrainage for successful cultivation. For the growth of specialized crops the indications to which these trees point may be in the opposite direction. On the Eastern Shore the occurrence of the Black Jack Oak is an indication of a sandy or light loam soil with excellent drainage, which would promise success with small fruits, berries, watermelons, sweet potatoes or peanuts. The occurrence of the same tree in the Mountain or Midland Zones, however, would have no such significance, for the rocky barrens in which it is most common, as for example the Serpentine Barrens in the vicinity of Dub-

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lin, Harford County, Gaithersburg, Montgomery County, the barrens of Elk Ridge in Washington County and the steep shale slopes to the northeast of Cumberland in Allegany County, are ill adapted to any crop. In the southern Eastern Shore the occurrence of a high percentage of Hickory in a deciduous or mixed forest may be taken as an indication of a deep loam soil, and points to the neighboring soils as having a high value as wheat land. On the other hand the Elkton clay of the Eastern Shore, characterized by White Oak, Loblolly Pine, Holly, etc., (see p. 109) is valuable wheat land, although not capable of producing as high yields as are got on the loam soils. In the upper Eastern Shore the bulk of the upland is well adapted for the production of high yields of wheat, which, together with the high percentage of Hickory in the oldest forests there, is in accord with the conditions in the southern Eastern Shore. The occurrence of the Tulip Tree on the Eastern Shore is an indication of soil in which the moisture content is too high for cultivation, although it is an infrequent tree in the upland forests of the upper counties. In the Midland Zone the occurrence of a high percentage of Hickory is of no significance in connection with the adaptability of the soil to wheat, and the presence of the Tulip Tree is quite equivalent to that of the Hickory on the Eastern Shore.

The fact that the majority of our native and introduced weeds are plants with a high degree of adaptability to different atmospheric and soil conditions and excellent capacities for seed dispersal makes them of only very general value in indicating the agricultural capabilities of soils. The weed flora of a field is much less a function of its soil character than it is of the source from which it was seeded, the surface conditions in which the soil was left, and the length of time that has elapsed since it was disturbed. In Part III. some facts have been brought out with regard to the difference exhibited by abandoned fields in successive years.

Such weeds as the White Daisy (*Chrysanthemum leucanthemum*), the Wild Carrot (*Daucus carota*) and the Narrow-leaved Plantain (*Plantago lanceolata*) are omnipresent throughout Maryland on soils of the widest diversity, in fields and waste grounds, both in open and shaded situations, and their catholicity of habitat is character-

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istic of perhaps a hundred other species. Still other species are wide-spread in occurrence but are much more abundant in certain sections of the state where soils of a partcular character are predominant. For example, in the counties of Southern Maryland the Dwarf Dandelion (*Adopogon carolinianum*), the Blue Toad-flax (*Linaria canadensis*) and the Ipecac Spurge (*Euphorbia ipecacuanhae*) are three native plants which are among the most characteristic weeds in old fields with sandy or sandy loam soil. The Gum Succory (*Chondrilla juncea*) is common in certain localities in Southern Maryland and at a few places on the Eastern Shore, where it grows on light soils. It is a plant which is restricted in its occurrence rather because of the recentness of its introduction than because of particular life requirements. The Yellow Horned Poppy (*Glaucium glaucium*) is an adventive plant which is confined to the sandy beaches of the Chesapeake and is one of the few introduced plants restricted to a definite natural habitat.

Particular attention was given during the field work throughout the state to the occurrence of the Viper's Bugloss (*Echium vulgare*) and the Great Mullein (*Verbascum thapsus*). Both of these were observed in every county of the state and on a wide range of soils from the shale-derived loams of Allegany County and the limestone clays of Washington County to the sandy loams and sands of the Eastern Shore. Both plants were noticed to be much more common in fields that had lain fallow for several years, because of their biennial habit. Much of the reputation that these plants have as soil indicators is due to the fact that fields which have become "run down" are allowed to lie in pasture for several years, these weeds then have time to develop and the fact that they are not eaten by the stock leaves them conspicuous over the field.

The spontaneous occurrence throughout the Midland section of the state of the Kentucky Bluegrass (*Poa pratensis*) and other turf-forming grasses is an evidence of the freedom of soil water movement into the surface layers of the soil occupied by the roots of these grasses. Throughout the sandy soils of the Coastal Plain, as in the states to the south, the maintenance of a close sod of such grasses is difficult, and their occurrence indicates that the physical character of the soil has been modified by artificial treatment in the

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FIG. 1.—VIEW SHOWING THE UPPER BLUE RIDGE WITH CHESTNUT, SCRUB PINE AND BLACK JACK OAK, EDGEMONT, WASHINGTON COUNTY.

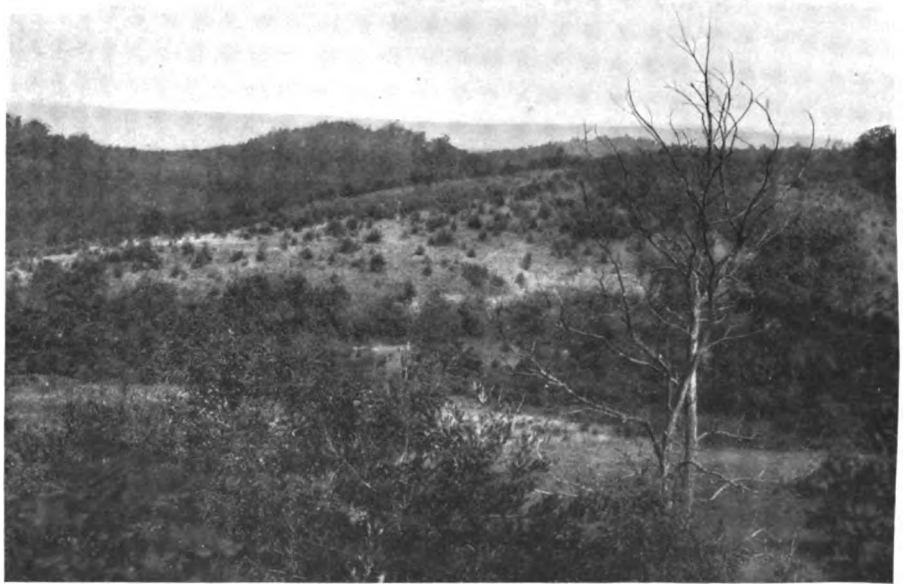

FIG. 2.—VIEW SHOWING SCRUB PINE REFORESTING ABANDONED FIELDS, NEAR SIDELING HILL, WASHINGTON COUNTY.

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direction of the character of the Midland soils. There does not appear to be any evidence that grasses are superior to other herbaceous plants as indicators of the value of soils or as indices for crop recommendations in a forested region like Maryland.

The only sound conclusions that may be drawn from the natural plant life of an area as to its agricultural capabilities are very general ones. The more specific the inquirer attempts to be as to the value of a particular plant association or a particular species in indicating favorable conditions for the growth of a particular crop the more is he apt to be led into error. The larger and more striking phases of the vegetation of Maryland which have been pointed out in the preceding pages are all dependent upon the several climatic and soil factors to which attention has there been called. Within small areas such as any one of the ecological districts of the state, the whole inquiry reduces itself to an indirect method for the estimation of the characteristics and value of soils. While numerous broader facts might be pointed out as to the desirability of the soil occupied by Loblolly Pine forest or Chestnut and Chestnut Oak forest or Upland Swamps for the cultivation of particular crops, these facts would be so far behind the experience and knowledge of agriculturists as to be of no value to them, however important they might be theoretically. That crop recommendations can be profitably made on the basis of the occurrence of a single tree species is doubtful for all but a few cases to which reference has been made, and these cases may not hold good in other parts of the natural ranges of these trees. The task of the pioneer who traversed the virgin forests of Maryland, and without any experience of the soils picked out favorable spots to be cleared merely by the indications of the size and character of the trees was infinitely easier than that of the botanist who traverses the state at the present day and attempts to draw any close lines as to the index value of native vegetation. What the pioneer was doing was merely to judge the unknown soils by the vegetation, and we today have too many direct ways of knowing the nutrient content of soils and the relation of their texture to water supply and movement to need the less direct and eminently fallible method of examining the natural or introduced plant covering.

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PART V

THE AGRICULTURAL FEATURES OF MARYLAND

BY

FREDERICK H. BLODGETT

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THE AGRICULTURAL FEATURES OF MARYLAND

BY

FREDERICK H. BLODGETT

Introductory.

The type of building found upon the farms of a region is a characteristic worth noticing, as it is directly related to the crops produced. On the tobacco areas of the Coastal Zone the best farm buildings, aside from the houses, which are omitted in this discussion, are the tobacco barns.

In the more severe climate of the Midland and Mountain Zones it is necessary to have shelter for the animals as well as for the main crop. And with the need of storage of fodder for winter use added space is required. These two factors unite in making a type of barn quite different from the one used in the tobacco areas. Sheds and shelters for implements and for the smaller animals, such as sheep and swine, are provided by thrifty farmers when needed, and are of a rather uniform type.

The tobacco barns are necessarily so built as to make possible the easy ventilation needed for the curing of the crop. The shelter of animals is a very secondary purpose, and is in many cases confined to the horses or mules, a shed sufficing for the other stock. As wheat displaces tobacco, the purpose of the barn changes, and where the growing of wheat is important, a large barn structure is common, usually in the form of a "bank barn:" This provides space within for the unthrashed bundles and for the sacks of thrashed grain; for hay; the more important machinery of the farm, and below a half basement shelters the stock.

For the benefit of those who are not familiar with the barns in the central part of the State, the characteristics of the bank barn may be mentioned. Ordinarily placed at the top or brow of a slop-

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ing piece of ground, the cellar is excavated so far as necessary from the bank, or hill, and the foundation is built so that a basement story of eight to ten feet is secured. Usually about two-thirds of the depth from front to back of the cellar wall is in the bank, the rest being in the clear for its full height. This detail varies with the shape of the hill against which the barn is built, but the greater warmth which the excavated cellar gives as compared with one built above ground makes the presence of the former the rule through the dairy region. The main doors of the barn are of a convenient height for

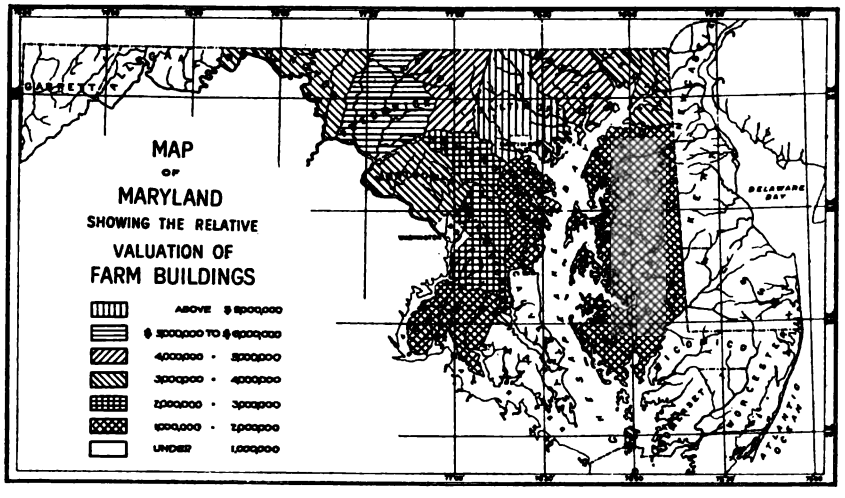

FIG. 9.—Map of Maryland showing the relative Valuation of Farm Buildings.

driving loaded hay wagons, or other farm teams directly upon the floor. To do this easily the approach is usually built as a gentle grade from the road, or directly to the door if the natural conditions make this possible.

The main structure of the barn, in a large number of cases, projects over the barn-yard for six to ten feet. This projection, called the "overhang," affords a shed-like protection to stock, from sun or rain, and makes a drier passage way for the farmer as he goes from one part of the stable to another. The stalls for the draft animals are commonly of the box type, the cattle having stanchions or neck chains in ordinary instances. Ventilators are inserted at intervals

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in the walls of the barn, and in a few cases were noticed as providing a change of air for the stable also. In the old stone and brick barns the ventilators are in the form of narrow slits running through several courses of the stone work of the wall; but in the brick barns a brick is left out at intervals in the wall so as to produce a series of openings over a space of several square feet, and repeated at intervals in regular patterns. Some among these old barns have stood for two or three generations, and look strong enough to last as much longer with but slight repairs to ridge and sills.

The total value of farm buildings varies greatly in the different zones, the Midland Zone leading in this, as well as in expenditure for implements and fertilizers. This is shown by the tables.

Historical.

SETTLEMENT.

The sections of the state included within the Coastal Zone were those which were easily reached by the first settlers in the region. Trading stations were established by William Claiborne at the mouth of the Susquehanna River in 1627-8*, and a definite settlement was made in 1629 on Kent Island by some of the Virginia Company's colonists under the leadership of Claiborne. In 1634 the first settlement under the Charter rights was made at St. Mary's City, near the mouth of the Potomac, and soon after (1637) the first county officers were in authority indicating the local civil unit in the colony. Kent Island was then incorporated as a hundred of the county, and continued subordinate to St. Mary's until 1640 when its county character is first recognized. Thus early is there present a division of the Colony into the Eastern and Western shore, the names coming into use a little later. But the two settlements were not brought under the actual authority of the Lord Proprietary until 1650, when the dispute as to jurisdiction was decided, and Kent Island was recognized officially as part of the Maryland territory.†

*Maryland Geological Survey, vol. vi, part v, The Counties of Maryland, p. 443, 1908.

†Further details of the early history of the Colony may be found in History of Maryland, John Thomas Scharf, 3 vols., 1879.

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The early settlements were located along the waters of the Chesapeake Bay and tributary rivers, as these were easily reached by the vessels in which the colonists arrived. The soils of the areas first settled were adapted to the culture of tobacco, which could be shipped from the plantation wharf with the minimum of transportation. The raising of this crop was the purpose of the colony, and easy shipments assisted in increasing its commercial value.

As the developing colony advanced along the shores of the Bay, toward its narrow head waters, certain places were naturally fitted to keep a considerable share of the business, and to act as market places for the plantations. Such localities developed into towns and cities, some with only temporary importance, others becoming more prominent as conditions changed. In response to the needs of these towns there came to be a slight difference in the agricultural practice of the farmers and planters nearest to the towns, the increase in proportion of wheat to other crops being perhaps the first noticeable change. The presence of a garden of more or less size as a regular part of each house unit in the early life of towns enabled the individual householder to be his own market gardener, the market in such case being his own table, or that of some neighbor. The regions near these towns of the growing colony, by gradual development made the equally slow changes in crops and practice required to keep pace with the increase in population. Tobacco gave place to such crops as were more directly related to human needs, as wheat, corn, potatoes, and later, fruits and what we know as "truck crops." The latter did not become of much importance until the transportation facilities were developed and stimulated the farmers into giving more attention to this side of their possible revenues.

Under the Charter the amount of land to which a planter could gain title depended upon the number of laborers or other help controlled by him, which was a kind of survival of the feudal relation of lord and vassal. Tobacco was the crop of the new country, and the two conditions of new land and a highly cultivated crop united to make strong and cheap labor essential to the profitable management of the great plantations. It is not surprising that the custom of shipping prisoners or "redemptioners" (from England) as laborers for the colony should have become an important practice both from

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FIG. 1.—VIEW SHOWING BORDER OF SLOPE FOREST IN MOUNTAIN ZONE WITH RHODODENDRON, WITCH HAZEL, HYDRANGEA, STRIPED MAPLE AND MOUNTAIN BLACKBERRY, NEAR ELKHART, ALLEGANY COUNTY.

FIG. 2.—VIEW SHOWING VIRGIN HEMLOCK FOREST WITH UNDERGROWTH OF MOUNTAIN LAUREL AND HOBBLE BUSH, NEAR BOILING SPRING, GARRETT COUNTY.

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a political point of view and from the viewpoint of the planters. These laborers received no wages, but would become free after a certain number of years. A step which was almost to be expected was that instead of purchasing prisoners to be bound servants, savage prisoners from other than the home country should be purchased as permanent property, thus doing away with the limit of service on the part of the servant. It is characteristic of the tobacco region that the cheap field labor was depended upon to bring the returns for the year, in the shape of the tobacco, and to earn its keep in the corn fields. In Maryland, in the sections where little or no tobacco was raised few negroes or other unpaid laborers were commonly found, and this early areal distribution of labor types has held good almost to the present time.

The tobacco was grown and cured by the planter, shipped from his plantation wharf, and the master of the ship took with him an extensive list of needed items to be brought on his return to the gentlemen and ladies whose hearts and thoughts were often in their home country though their manor house was in the Colony. The planters of the Bay shores continued their dependence upon the home country until the war of Independence compelled the general development of industrial resources of the Colony. This was especially true in respect to tools, and clothing materials.

Iron was smelted in the Colony, and pig iron was an important export before the Revolution, but upon the Coastal Zone little or none of it was forged into tools, those needed being brought back from the other side with other merchandise in exchange for the tobacco sent from the Colony.* Not only as a medium of foreign exchange did tobacco serve as a "money crop" but at home as well did the staple crop have value in exchange, and take the place of more convenient coined money. As late as 1752 tobacco was declared legal tender at one penny the pound, and taxes, fines and salaries of both ministers and judges, were paid therein even considerably after that date.

*Scharff, History of Maryland, ii, 60, 61.

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CLEARING AND CULTIVATING.

Tobacco was from the first the important crop, and it soon became evident that only the richest land would produce the best crops. Since the best land was that richest in humus it followed that as a field became impoverished, new land was cleared and planted to the staple crop, leaving the older fields to the less important, and less exacting plants of the colonists, and finally to the "Old Field Pine."

In order to get a given area of the forest into cultivation as quickly as possible, the Indian method of girdling the trees was made use of, the slower method of cutting and burning being used to a much less extent. The trees continued to stand for several years after girdling, the twigs, branches and finally the bark dropping to the ground, leaving the gaunt skeleton in the midst of the field, which might even be exhausted and abandoned to its wild fate, before the forest monarchs decayed and fell. This is probably the most wasteful of any method of transforming the wooded areas into tilled fields. The method of "slashing," or cutting and burning, is only less wasteful in that the ashes of the destroyed trees add to the fertility of the soil, which may however be injured locally by the heat of the great fires quite as much as the ashes can benefit it by their presence. In each of the two methods mentioned, the first desire was to get the ground ready for the chief crop, the trees being only a hindrance to that end, and the wastefulness of one or the other means used did not figure in the result, or in the plan. These same methods are still to be seen in the remoter parts of the state, although there are not many areas left where the trees are so much of an incumbrance as to call for their mere destruction in order to use their place for planted crops. The waste in present lumbering methods is quite as serious as this girdling and slashing, for not only is the crop of trees only in part utilized, but by fire, or careless felling of the trees, or too close cutting,—often by all three,—the ground is rendered practically barren; neither planted crops being introduced, nor the natural one of trees being allowed to restore itself on the area cut over.

The present wastefulness in lumbering methods is a direct inheritance from the days when the trees were an incumbrance upon the

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land. In fact the presence of the forest was originally a source of actual danger, concealing hostile Indians or dangerous animals. The habit then acquired of getting rid of the trees by the easiest methods, for safety, as well as for agriculture, is responsible for the later indifference to the consideration of timber.

The heavy demands upon the soil, made by the system of repeated tobacco crops, soon removed the most available elements of fertility, and resort would then be made to new soil, made to yield to cultivation in the way mentioned in another paragraph. The means for cultivation of the ground possible in the days of the Proprietary Colony, were quite different from those of the present. There were no plows with iron or steel mold boards, or shares, the best having flat oak mold boards with a point of iron and perhaps in the case of especially ingenious or progressive farmers having a flat plate of iron nailed to the surface. It was thus impossible to plow deeply or to throw a well turned furrow. Hand work was called upon to make good the deficiency of the plow, and the hoe in the hands of the slaves became a steady implement for the preparation of the soil as well as for later tillage of the crop planted. The hoe which did so much for the agricultural development of the Colony, was not the bright sharp-edged tool of the present type, but more nearly a mattock in weight and size. Although it was not so long and narrow as the mattock, still the amount of iron used in its construction was apparently not much less. That a hoe of this type was the best for the work to be done is quickly seen if one remembers that the fields in which the crops were grown still had the stumps, or even the standing trees, scattered through the corn or tobacco, and the roots, decaying but slowly, were constantly being encountered as the ground was worked. With a light hoe of the present type, it is sometimes difficult to strike a sufficiently hard blow to cut through the root of a well developed weed; such would have been useless then in the work of actual tillage.

The hoe was so thoroughly recognized as the farm implement of the plantation, that the year's plans as to acreage of corn and the number of hills of tobacco were calculated on the basis of the hoeing power of the hands. It was calculated that a negro could do the necessary work in the field, using the hoe, to care for 37,800 hills

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of corn, equivalent to five acres; and 6,000 hills of tobacco was the season's task in the tobacco field for one field hand.*

Reference has been made to the importance of numerous laborers in the agriculture of the Colony, both as to the actual working of the fields, and as to the acreage of one planter's holdings; and to the wasteful methods of clearing, exhausting, and abandoning the land required for the production of tobacco. Not every planter thus severely treated his land, for we find that apple and other fruits were set out in the fields on which tobacco was no longer a profitable crop, in St. Mary's County as early as 1656, and it is probable that the custom was practiced to a considerable extent among the more thoughtful of the planters.† The more careful and observant colonists learned to conserve the fertility of their fields by the use of marl, which is abundant in some parts of the Coastal Zone. The wild fruits made up then to a large degree the relish dietary furnished by the more highly developed but not always better flavored fruits of the present growers, just as the different wild game animals and birds of many kinds, furnished the early supplies of meat in a reasonably sure and economical manner.

EXPANSION.

One condition as to location was imposed by the lack of roads or other means of land communication; the tobacco had to be grown in regions convenient to navigable waters. The two "Shores" of the Bay met this requirement through the numerous rivers and creeks which are navigable for many miles inland from their mouths and still are in great measure the routes for freight transportation. The settlement of Maryland by the colonial planters under the Charter, was a progressive advance from the mouth of the Bay towards its head. The deep estuaries from the Bay and along each shore, made the shipment of tobacco easy even if the plantation was some distance from the Capes. But the area suitable to the cultivation of the staple was narrower in the upper part of the Bay than lower down, and as the demand continued to grow, other lands were developed

*Scharff, History of Maryland, I, 13-60.
†Scharff, vol. II, p. 6.

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at a distance from the navigable water and the "back-woods" began to be settled.

The Bay region was in general level, and easily accessible from the water; to go inland one had merely to follow the tongues of land between the different streams, with no considerable hills to climb for many miles in the lower counties, the distance decreasing as the head of the Bay was reached. From the region about Baltimore northeastward, the higher ground comes closer to the shores of the Bay, and the level Coastal Plain area is correspondingly decreased. A considerable series of long hills or ridges extended as a barrier across the path of any who would go westward, and similarly checked the travelers from the western side from reaching the coastal region. Thus each group developed with but little influence on the other; the Indian trails, enlarged to allow the passage of pack animals, being the first means of communication. The streams which rise in the ridges between these two areas of settlement, flow in opposite directions, the dividing line of the two systems of drainage being in the midst of the ridges. Thus there was no chance to use these natural lines of travel for any extensive communication as was possible in the case of the Potomac and Susquehanna rivers, the head waters of which lie beyond the ridges and lines of hills that are here mentioned.

It was not until the settlers in the valleys or those of the Bay, found that trade in their surplus products was possible with the settlers of the other region, that trails were cut for regular trade, and the business of the trader began to develop into a larger form than mere barter. In this development it appears that there were three centers of trade, at Georgetown on the Potomac, Annapolis on the Severn, at Joppa and later at Baltimore, practically at the head of the Chesapeake. At these points the surplus from the cargoes of the vessels returning from their tobacco voyages naturally were stored and the products of the interior could be easily exchanged for such imported articles as were of greatest value or otherwise were desirable.

As the settlement of the tidal regions became more complete and the localities away from the water front were occupied, it was found possible to get the tobacco to market from these plantations by roll-

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ing the hogsheads over trails cut through the woods to some convenient landing. These trails were known as "Rolling Roads" when their character became more permanent. One such still holds its name near Baltimore, running north from Elk Ridge Landing into the western portion of Baltimore County.

As the colonial government developed it became desirable to have the tobacco which was grown in a given region shipped from a definite place. The colonial tobacco inspectors were located at designated ports, and it was enacted by the Colonial Assembly that shipments should be made from these ports. Among the places so indicated, Annapolis is mentioned in 1649* and roads were cleared to aid in bringing the tobacco to the wharves.

The grain crop required no special transportation facilities, as much of the crop was utilized on the place where it was grown, being ground on the premises, or in the neighborhood, the element of distance being practically eliminated. The ready adaptability of sacks as units in pack trains made the carrying of grain and of flour an easy task.

TRANSPORTATION.

The easy communication and convenient transportation by water had great influence upon the Bay settlements. The development of other means of communication was of importance to other parts of the State, as one can see by a brief glance at the history of the main routes which have been built in this State, and extending in their growth far beyond its limits.

The first roads seem to have been developed in the Coastal Zone to meet the requirements of the sessions of the Assembly, but only slowly even for this purpose, since many of the members could reach the place by the convenient Bay and its tributaries. The first actual road building, however, so far as records show, was done in the region between the Delaware and Elk Rivers, by the Herrman family, to facilitate communication between parts of the family properties, and to aid in the establishment of communication between the Bay and New Castle, Delaware. The conditions in this

*Scharff, i, 421, 422.

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section of the Province were so favorable that Cecil County was erected in 1674, lying between the Susquehanna and the Chester Rivers. The settlements along the Delaware, especially Phildelphia, gave impetus to the construction of roads in the north-eastern section of the Colony not present elsewhere, and this was also in the route of the north and south travel, from south of the Potomac to New York, or beyond.*

Roads.—The actual development of roads to facilitate the transportation of agricultural produce, which is of chief interest to us, did not begin until the country to the west of the Coastal Zone became sufficiently well occupied to receive consideration by the County Courts. Thus in 1712, under the authority of the Court of Prince George's County, a road was opened between the Eastern Branch of the Potomac and the country near the head of Rock Creek; that is, across the region lying to the northeast of the District of Columbia, and included now in the adjacent portions of Prince George's and Montgomery counties. This was part of the route used by the German settlers entering the Monocacy Valley, via Annapolis, passing south of Parrs Ridge to Frederick. From this part of the Colony there were connections with the adjacent parts of Pennsylvania along several routes, the most important one being the Monocacy Road. This ran northward to Philadelphia by way of Lancaster, and extended southward into the Virginias, crossing the Potomac near Williamsport at the mouth of the Conocheague Creek. By this road the settlement of the Monocacy Valley was stimulated. As a result of the comparative ease of communication, together with the generally favorable farming conditions, the town of Frederick was laid out in 1745, the first house having been erected in 1735. The next step of importance to the agriculturist was the opening or laying out of routes between Frederick and Annapolis, and to Baltimore; and also one to Georgetown on the Potomac, important as being at the head of navigation of that stream.

The establishment of settlers, and the accompanying growth of towns in the interior sections of the Colony made the gradual extension of the routes a necessity and this later growth of existing

*For a detailed discussion of the roads of the State see Maryland Geological Survey, vol. iii, 1899, 109 et seq.

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lines of transportation need not be taken up. But the use of roads, in the place of the former trails, meant the widening of these to allow the use of wheeled vehicles, which had previously been rare in the hauling of the colonial produce. The absence of iron in convenient form for use, made the early wagons heavy and cumbersome affairs, the wheels being sawed from logs of suitable sizes, and not built with the modern method of spoked wheels. Spoked wheels were of course in use on the coaches for passenger travel, but these were imported, the freight vehicles being of domestic manufacture.* The owners of the pack horse trains were opposed to the improvements in roads for the accommodation of wagon traffic, as they supposed it would ruin their trade, and at a later time the wagon freighters opposed the development of the railroad upon the same grounds. That there developed a considerable freight business is shown by the statement that in October, 1751, in two days, sixty wagons loaded with flaxseed came into Baltimore from the "back country," in the central part of the Colony (Frederick and Carroll counties and the vicinity of York, Pa.)†

Baltimore became the terminus of the roads extending into the region just mentioned and as the trade increased, its importance increased because of its position at the junction of the routes by land and those by the Bay. Its business was thus practically assured, from the time that there was recognized a possibility of traffic along the routes named.

The extension of the French settlements into the Ohio Valley is responsible for the Washington and the Braddock Roads of 1753-4, and 1755 respectively, from Fort Cumberland westward toward the Ohio, a part of the route then laid out being later used for the National Road, but its steepest grades being avoided by relocation. The road in this part of its route had but little to do with Maryland farm life or the produce of the farms. It was not until a road was laid out to connect the settlements in the Valley, the Hagerstown and Frederick region, with the country in the vicinity of Fort Cumberland, that the plantations and farms in the older

*See Schulz, First Settlement of Germans in Maryland, p. 19.
†Maryland Gazette, October 30, 1751, quoted in Mereness "Maryland as a Proprietary Province."

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FIG. 1.—VIEW SHOWING STREAM BORDER IN VIRGIN HEMLOCK FOREST WITH MOUNTAIN LAUREL, RHODODENDRON AND HONEYSUCKLE, NEAR BOILING SPRING, GARRETT COUNTY.

FIG. 2.—VIEW SHOWING NARROW FLOOD PLAIN ALONG STREAM IN VIRGIN HEMLOCK FOREST WITH AMERICAN YEW, NEAR BOILING SPRING, GARRETT COUNTY.

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part of the Colony became directly concerned in the road as a route for traffic, or as an outlet for produce. The direct purpose of this road was for the better communication between the two Forts, Cumberland and Frederick* about which settlements were growing up, which were dependent upon them for protection from the Indian troubles which at intervals following Braddock's defeat were of serious importance. Settlements followed the line of communication that was thus opened, and agriculture thus spread westward along the road.

The National Road, for which moneys were first appropriated by the Congress in 1810, extended westward from Cumberland toward the settlements of the Ohio valley. The name has been extended to cover the main turnpike route eastward from Cumberland through Flintstone, Hancock and Hagerstown to Frederick, and the term "National Pike" is applied also to the road through Mount Airy eastward. This system of roads was in fact the feeder for the National Road proper, as it brought the freight to the starting point at Cumberland. These roads were of much importance in the development of the agriculture of the central sections of the Colony, and the German settlers of the Monocacy Valley were thrifty in their use of such routes for the marketing of their produce.

There were two roads of importance across the central Valley area as early as 1805†, one from the District of Columbia and the other from Baltimore, which ran westward to Frederick, thence to Williamsport. These were directly related to the National Road as its antecedents and feeders. For a considerable time the Road lead through unsettled country, but the favorable locations along the route were gradually taken up, and the country became settled from the roadside back into the wilderness. The extension of the highway between Baltimore and the Cumberland end of the National Road, was largely the work of an association of banks, which formed an incorporated company for the building of the necessary connections between the City and the Road to Ohio. The road so built is sometimes referred to as the "Bank Road." The completion of this system of transportation routes, about 1820, from the Ohio

*At Cumberland and near Big Pool, Washington County, respectively.
†See Maryland Geological Survey, vol. iii, p. 182.

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River to the seaport of Baltimore was of great importance to the latter. Its influence was felt by the life all along the route of the road, from which a large amount of freight was drawn in the shape of farm produce. It is this "Bank Road" to which the name "National Pike" is commonly applied in the counties between Cumberland and Baltimore.

Canals and Railroads.—Soon after the turnpikes were thoroughly established as freight routes, the project was revived which had been more or less dormant since the time of Washington's Potomac Company. This contemplated the building of a canal westward to the Ohio River for the conveying of freight across the mountains between the seaboard and the interior. In 1823 a convention met in Washington, and declared in favor of a canal route to the West. Surveys were made for a canal to Pittsburg, by way of the Potomac valley to the Savage river and across the divide to the Youghiogheny at Bear Creek, then by the valley of the Youghiogheny to Pittsburg. On account of the development of steam transportation the canal was not built farther than the mouth of Wills Creek, at Cumberland, to which point it was completed in 1850. The railroad had in 1840, reached the canal terminus. The canal thus found a more speedy rival to meet instead of having a clear field to draw upon for freight. It has not figured largely in the agriculture of the State, the chief canal freight being coal from the vicinity of Cumberland. Wheat was carried to a considerable extent however in the earlier years. This was ground in the mills at Georgetown, which obtained their power from the canal waters.*

The influence of the railroad upon the development of agriculture, especially in the Midland and Mountain Zones, need not be mentioned in any detail. The fact may properly be stated that the presence of a rail route from Baltimore westward through the Patapsco Valley, past Ellicott City and Mount Airy stimulated settlement and agriculture in the Upper Potomac region. The other routes leading into the upper part of the State have had a direct influence upon the development of the different types of farm prac-

*For further details, see Early Development of the Chesapeake and Ohio Canal Project, Johns Hopkins Studies in Historical and Political Science, Series 17; Nos. 9, 10, 11, 1899.

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tice, especially such as dairying, truck raising, and fruit growing, market cities being conveniently near. These lines of transportation were by way of the valleys of Gwynns Falls, the North Branch of the Patapsco, and Little Pipe Creek on the one hand, and more directly to the north by Jones Falls and upper Gunpowder river valleys on the other.

NATIONALITIES.

The policy of the Lords Baltimore which allowed freedom of conscience to all who came into the Colony, was a favorable element in the development of a varied population of the several important groups then active. The Church of England and the Roman Catholic Church which were both represented among the first settlers at St. Mary's City, continued to share the rights and privileges of the Colony for a long period. From Delaware there came Sweedish settlers in 1661-1662 who had found the conditions there unfavorable for them. Puritans settled in the region about the Severn river, and Anne Arundel County was erected in 1650 in recognition of their influence in the affairs of the Colony. Quakers came over the line from Pennsylvania, especially along the Susquehanna River, and the Germans who came to occupy the central valleys of the colonial area in 1735, brought with them their Lutheran principles and German methods.*

The diversity among the settlers who thus became established in the Maryland Colony made it different from those in which less toleration was allowed, and helped to pave the way for the prominent place that the Colony was later to take in the preparation for Independence and Union among the colonies. The broad and generous attitude of the colonial authorities toward those who might differ somewhat from themselves in certain details of their manner of life, resulted in the settlement in the Colony of groups of people having diverse experiences, and histories. The benefit of this was reflected in the varied kinds of farming that came to exist in the Colony, and the important place it took in the maintenance of the

*See First Settlements of Germans in Maryland, E. T. Schultz, Frederick, Md., 1896.

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Continental Army in the long struggle for independence. A diversified agriculture is of benefit to a community in that it raises the standard of living, by making possible a variation, substitution, or alternation, of food substances not available when there is no such diversity in crops or produce. It manifests itself also in being able to secure returns from some one crop in case another proves a failure in the same region. Thus the toleration of the authorities toward the settlers was of benefit to the Colony in broadening its agricultural resources.

In the region of the Monocacy where the German colonists began to settle as early as 1710, and came in large numbers in 1735, the local resources were developed early. The requirements of the neighborhood were supplied by the industry of the settlers of the vicinity, if each one did not meet his own needs. Here forges were associated with the smelting furnaces for iron, and the flax and wool of the farms became the sheets and clothing of the homes and farmers.

A difference between the farm unit in a new and in an old region, which is very essential but often overlooked, lies in the relation of the natural resources of the locality to the cultivated ones. The farm in the new country yields only the bread stuffs and essential vegetables like potatoes, while the wilderness around supplies the needed meats, and such fruits and berries as there may be opportunity for gathering. In the older region however, the farm must not only produce the bread and vegetables of the daily fare, but the meat also. And from its surplus must come the revenue to purchase the needed accessories of better tools, of more clothing and the other features of neighborhood life which differ from the frontier conditions. There the game killed for food furnished in many cases the clothing also, as in the case of buckskin, or was the revenue of the pioneer, as in the case of beaver and other skins. The demands upon the land and the productivity of the soil, by which the demands may be met, seem to be related, at least in time; and the productivity is in turn related to the character of the demands which must be met. It is in the region of good crops that the different accessories of life are to be found in home comforts and labor-saving implements. Where the soil has the greatest demand laid upon it the demand is met by the farmer through the intelligent application

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of the best principles of agricultural practice. By the use of the improved varieties of plants, the improved methods of tillage, more intelligent arrangement in succession of crops, and better choice of each crop to be grown at a particular place, the yield of our crops has been increased. But there is more to be gained still, which will be gained as the principles now new to many become the property of all, resulting in the more careful selection of seed corn or some special type of grain adapted to particular conditions, or of some other detail the underlying principles of which have been but recently recognized.

The Labor Problem.—One of the most important factors in the development of agricultural methods and customs is the recent history of the people who may be under consideration. In the present case the settlers who were accustomed to their servants in the mother country, found difficulties facing them in the new land that were of a different character from those which faced the settlers who were accustomed to be their own reliance in the matter of labor. Similarly, those who under these conditions supplied their own needs developed a different type of community from that which grew up in the region of easy transportation and dependence upon the home country. One is apt to continue along the lines already familiar, and to endeavor to make the new conditions meet the older customs, as far as possible. Thus the growing of tobacco was in itself a new business, or custom; but the planter adapted the custom of tenant labor, or at least labor other than that of his own family, to the new requirements. The idea was modified from the first form of indentured servants bound to the settlement for a term of years, to the later form of purchased slaves of a foreign race. This was an easy step and had the distinct advantage of permanent tenancy, if one may so think of it for the moment, and a total absence of regular wages, or of "shares" or other payments to the "tenants."

Those to whom the tenant system was not an essential were not so much in need of cheap labor, and their farm customs developed along different lines, which required fewer field laborers and also fewer household servants. The results of these two types of farm

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or plantation life are reflected in the homes that were built in the regions where the respective customs prevailed. Abundant servant help went with the extensive mansion of the Coastal Zone plantation, the kitchen being in a separate building, often duplicated on the opposite side of the mansion by the office of the overseer. The absence of numerous servants is reflected in the more compact houses of the Midland and Mountain Zones, in which regions the kitchen is a part of the house proper and not removed to an adjacent building.

The slave was a factor in the tobacco section by which it was possible to make the crop. In those sections of the State where the tobacco was of less consequence and which were settled by a different type of farmer, the need of slave labor was not so great and their numbers were much less.

The present conditions of labor and agriculture vary in somewhat the same manner as during the earlier years. Where the labor is efficient the general tone of farm life is thrifty; where the labor is lacking in this respect there is often a decrease in the appearance of prosperity. As a very general statement it may be said that very large units are the most difficult to care for economically. The smaller holdings can be more fully utilized with a given expenditure of time, labor, and money.

Influence of Soils.

The question of the relative fertility or suitability of a given soil for farming purposes does not enter the mind as a question of fundamental importance, so much as does the thought of convenience to market, or to transportation facilities. If this is the case at present, it was still more so in the earlier days when the competition between the several regions was less keen, and there was less demand upon the soil for its maximum return for labor expended. The subject of soil characters in connection with farm practice is receiving much attention at present, and the careful farmer is beginning to choose his new location or select his crops in accordance with the mutual relation the two have been found to bear to one another. This may be illustrated by a single example in Maryland.

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In the vicinity of Hagerstown there is an area of former swamp or bog land too wet for ordinary crops, but of such a loose and easily tilled character that some crops would do well in it if only the right one could be found. A consideration of the region in which some of the great celery farms are located showed the owner that this soil was suited to this crop, and the test of a trial crop was made, since which celery has been a staple crop on that farm.

In considering the relative fertility of different soils, it is difficult to make statements of a positive character concerning the influence of small variations in the composition or texture of the soils mentioned, or present in a given area; for the differences in the farm practice of two neighboring farmers upon the same soil, are often such as to produce as great difference in the year's returns as is found between two at a greater distance from each other and on soils differing materially in respect to the rock from which they have been derived. Where the soils differ in the way mentioned in connection with serpentine, and limestone, or certain shales and gneisses, the differences of the individual methods cannot make good the absolute lack in the one case of the necessary elements to make a soil, and provide food for the possible plant growth, or in the other case, to so alter the texture as to make the soil produced by weathering of the shale of a character more useful to plant activities and more retentive of moisture, except in a very slight degree. Thus any statement as to relative fertility of the several sections of the State are necessarily general averages, and serve to indicate the general tendencies of the section, rather than the positive results of individuals.

Trees and Soils.—In the slow processes of Nature, the gradual weathering of shale into soil was fast enough to furnish support to an extensive and valuable natural crop, the forest growth. But with the substitution of human haste for deliberate Nature, there comes a great change. The trees are removed, the steel plow loosens and overturns the soil, corn is planted in the raw earth, and then the rains come. The humus that had been accumulating for decades by the gradual contributions from the trees, is now below the surface, buried by the plow. Only raw soil is exposed to the rain, and

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this can retain but little of the downpour. Rivulets form, these combine into larger streams, and soon a channel is begun along the line of the furrow and the work of washing is started.

Certain types of soil should never have their natural cover of trees entirely removed because of the ease with which the soil particles are washed away in any heavy rain. Such should be permanently in forest, and the tree growth so secured would be a source of revenue to the individual owner. The rapid runoff of the rain and snowfall would be checked and the water supply of springs and other sources of stream flow would become more regular. The loose shale soils form agricultural areas of poor returns in the way of cultivated crops, and aside from the possible profits available they are difficult to work. It is such soils as these which should be permanently devoted to the crop of forest trees, and the tree growth on them cared for as if it were a permanent crop, instead of a temporary supply which must be used all at once.

In the more valuable agricultural areas, winter cover crops should be utilized to prevent similar damage by heavy rains upon light loam soils.

COASTAL ZONE.

The soils of this region are as a class formed by the deposit of material by water, at a time when the sea level was at a higher point than at present. Under these conditions the various types of sandy and loamy or even clayey soils are found in areas of considerable extent and having a nearly level surface. In the portion of the Coastal Plain designated as the "sub-aqueous area" below the present sea level, the same process of deposition of transported soil particles is now going on to form additional areas of nearly flat land. If the whole coastal plain should be raised a hundred feet above its present level, the gentle slopes of the Eastern Shore would extend beyond the present beach line and be correspondingly greater in area. This variation in land area has occurred several times according to the Geology of the region,* and at each change in level the soil materials have been worked over by the wave and current

*See Physical Features of Maryland, pp. 144-5.

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FIG. 1.—VIEW SHOWING GLADE AND SWAMP, FOREGROUND CLEARED, BACKGROUND WITH SECOND GROWTH FOREST OF BLACK SPRUCE AND TAMARACK, NEAR THAYERVILLE, GARRETT COUNTY.

FIG. 2.—VIEW SHOWING HERBACEOUS VEGETATION IN SLOPE FOREST WITH DRYOPTERIS, TRILLIUM, DISPORUM AND CAULOPHYLLUM, GREAT BACKBONE MOUNTAIN, NEAR SWANTON, GARRETT COUNTY.

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action of the sea. With the exception of a few boulders there are almost no rocks in the Coastal Plain, the soils being by nature of their origin deep and easily tilled.

The possibilities of selected crops on special soils will help to solve the question of the swamp areas of the lower Bay region, when that section has been thoroughly drained by ditches, as has been done with very similar areas in New Jersey, where the increased value in quantity and quality of hay made from the self-sown grasses which grow upon the drained lands, was more than enough to pay the expense of ditching.*

Differences in soil texture are accompanied by corresponding differences in the water content, and thus the methods of farm practice vary with the differences in soil. The great aim on the part of a farmer is to secure for his crops the greatest benefit of the soil-moisture and the accompanying fertility, and to reduce so far as possible the loss of these through the growth of undesired plants, the weeds, or through excessive surface evaporation from the soil itself. The first of these may be largely controlled by the use of the various cultivators and weeders, that loosen the soil in which the weeds are growing, and more or less perfectly throw them out upon the surface to wilt and die. The second source of loss is partly met by the loosened surface accompanying the weed-killing work of the cultivator, but is best accomplished by the supplementary use of some pulverizing implement, following the regular cultivator.

On the stiff clay soils of Dorchester County, a form of roller was seen in use that was not noted in other sections of the State. The field itself was in corn, which was twelve to eighteen inches high. The compact clay formed large clods and thus exposed a great surface to the air and to evaporation. These clods were compacted together and crushed to a considerable extent by the roller, which was so built that the soil between the rows of corn was rolled by its passage. The roller passed down each side of a row of corn, the corn plants having a space between the two sections of the roller; just as in a wheeled cultivator the cultivator spans the planted row, and loosens the soil on each side of it, so here the roller spanned the row and crushed the soil on either side.

*See Bulletin 207, New Jersey Experiment Station, 1907.

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For the same purpose, conservation of moisture and compacting of the surface layer, there is in use in Worcester County, upon an area of sandy loam, a drag much like a small stone boat, which is used in the rows immediately after the passage of the cultivator. This treats but one row at a time, and is drawn by a single mule or horse, the boy driver sitting upon the drag to make it the more effective as a soil compacter. Often after a rain this drag is run between the rows without the preliminary use of the cultivator, as it is in effect a very fine toothed weeder or cultivator, and this prevents the loss of moisture by the prompt production of a dust mulch over the surface.

The value of these light soils for the early and quick growth of crops, is shown in the trucking industry, which is most largely developed on the soils of the coastal plain type. Their light and friable texture is unfavorable to the production of turf forming or pasture grasses, especially on the Western Shore.

MIDLAND ZONE.

In contrast to the soils of the Coastal Zone, those of the Midland Zone are not of material transported from a distance, and rearranged by a large body of water acting by wave and current upon the transported particles, but the soils are formed in place by the weathering of the rocks which underlie them. Thus the character of the soil is found to vary in its fertility as the composition of the original rock differs, and according to the manner in which the rock is broken down into soil. For example, the region in the vicinity of Mt. Washington, Baltimore County, known as "Bare Hills," is one of the poorest of farm soils because of the lack in the rock itself of minerals, such as feldspar which would by their decomposition form a soil. The serpentine rock which forms an extensive outcrop at that point does not contain the substances that are available for plant nourishment, and they are bare of plant growth to a degree not often seen.

The rocks of the Eastern extension of the Midland Zone, have mostly come from the gneisses, and usually form fertile and rather compact soils, open and deep in texture, well adapted to the raising of general farm crops. The gneiss soils are favorable to grasses,

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including pasture types, hence dairying is extensively conducted by the farmers along the railroads which cross this region. The same soil and farm characteristics extend into Carroll County, especially in the part east of Parr's Ridge.

Valleys.—The rock matter may be reduced to a soil of a high degree of fertility with both composition and texture of a favorable character. In this class fall the highly fertile valley lands along the Monocacy and its tributaries, in the Middletown Valley, and in the Hagerstown Valley, between the Blue Ridge and North Mountain. Much of these lands are of limestone origin, and rank among the richest of the State. Special bands of soils differing from the type occur in sections where rocks of different composition form outcrops in the general mass of more uniform character; such is the belt of "red soil" in Frederick County, caused by the presence of a rock containing more iron than is usually present in the vicinity. A few miles above the "Fall-line" in the vicinity of Gaithersburg, there is an outcrop of serpentine, that is almost useless for farming, being but little better than that mentioned before as forming the "Bare Hills" area.

The limestone soils are chiefly formed of the residue left behind when the more soluble portions of the original rock were carried away in flowing water. The process is continuing along the surface of the limestone ledges, but so slowly that it is not conspicuous. Soils so derived are much benefited by top dressing with burnt lime. The explanation lies primarily in the physical action of the lime, not in its fertilizing action. The soils are fine loams approaching more or less closely to clay condition, and as such are largely composed of the fine silt particles that become flocculated, or coagulated by the action of the caustic property of the lime. The result is to make the soil somewhat more of the nature of a coarser loam in especial reference to the drainage and plant-growing power. Very much the same result is attained when manure containing large amounts of plant remains, bedding or other trash, is plowed into a clay soil; the addition of vegetable matter loosens the soil and gives it a chance to become better drained, and lets in the air, all aiding to increase the succeeding crops, as compared with those before the treatment.

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Shale Ridges.—Westward from North Mountain, the soil character, the vegetation and the farm life appear to change almost immediately with the first outlook over the upper Potomac Valley from the crest of the mountain at Fairview. From this point the country appears clearly divided into the cultivated area of the Valley eastward, and into the wooded slopes of the small and large ridges westward. The blue haze hides all detail in the distance, but these differences on the two sides of the crest continue as far as the eye can see, and form the characteristic features of the respective sections of the state.

The farm land is occupied in smaller holdings, and may appear as mere clearings in the woodland for most of the distance from Fairview to Hancock, but there one finds more extensive farms and more active agriculture. As the transportation facilities are poorer than in the region just passed, this may account for the difference in development to a considerable degree. This difference will become less from now on, as transportation by rail is now possible in the section between North Mountain and Hancock.

While the general soil conditions from North Mountain westward are unfavorable for the best agriculture, just west of Hancock there is a considerable area which is better than the region between that point and Fairview. The land is underlaid by thin bedded shales and limestones which disintregate to a soil of good quality. The steep slopes of the valleys draining this area make cultivation difficult, but grasses form good turf and washing is much diminished. The upper slopes of the ridges are largely set out in fruit orchards, the lower slopes affording pasturage, or grain fields. Sideling Hill with its masses of sandstone limits this area of good ground on the west.

From Sideling Hill to Cumberland there is a succession of hills or ridges, largely in timber on the slopes, and in cleared farm lands on the lower ground between, or near the crests. The character of the farm work compares with that east of Hancock, and to a considerable degree for the same reason, i e.—character of soils and distance from transportation. The soils in the region from the top of Sideling Hill to Flintstone are largely shales like those between Clear Spring and Hancock, but in the region just east of Flintstone there is a stretch of valley land having a shale foundation which

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is of fair fertility. This may be due to the influence of the nearby limestone hills which drain into the valley, and from which the soil particles have been gradually washed into the lower area.

The quality of the agricultural lands improves as the hills to the west of Flintstone are approached, as these and the slopes at the foot are composed to a considerable degree of thin limestones, with a considerable amount of shale in associated beds. These soils are of a character suited to the growth of wheat and corn, and in this region a considerable amount of hay is also raised. Oats and rye are grown to a considerable extent, wheat not doing well on the higher ground and being replaced by the other cereals. The farm buildings in this limestone belt resemble those of the broad valley lands about Hagerstown or Frederick, being of the same substantial character, often of the bank barn type, and large to correspond to the crops cared for. The contrast in a few miles between such barns and the log barns of the steeper slopes, and less productive shale soils is strong evidence along the line of soil fertility as influenced by the source from which the soil has been derived, i e.—from shales of unfavorable weathering qualities, or from limestones which weather to fine loams.

There are two belts of the more fertile type of soil between the valley at Flintstone and the edge of the Midland Zone at Cumberland. The characteristics of the two areas are so similar that more detailed mention of them is not needed, the last paragraph giving the essential features. Between these fertile areas there are exposures of the same shale soils that have been seen at frequent intervals since entering the ridge region at North Mountain, and these continue to the immediate vicinity of the city of Cumberland, as may be seen by reference to the map accompanying the volume on Physical Features of Maryland.

MOUNTAIN ZONE.

The Mountain Zone, extending from Cumberland to the western boundary of the State, is a part of the Plateau area which extends into Pennsylvania on the north, and into West Virginia on the south and west. Ridges are still present, but they rise from a base already

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elevated to a considerable height before their slopes are reached, the appearance of height being less than in the region of steeper slopes but lower elevations about Cumberland.

The Zone has not yet been strongly developed in an agricultural way, the area being less highly cultivated than the regions which were settled earlier. The soils are in some considerable areas of sandstone origin, there is some little limestone, and a series of shales is also present, but of a different character from those previously mentioned. To a large extent the whole country is still in forest, or in the condition of waste land that follows the ordinary method of lumbering, but a few sections near the railroad being under careful cultivation.

The general features of elevation and its associated phenomena of temperature and moisture have been discussed in an earlier chapter, the same factors have an important bearing upon vegetation and hence upon agricultural practice. The general conditions of climate in this Zone are such as to make the arrival of Spring two weeks later, and of Autumn two weeks earlier than in the region at the foot of the Mountains as at Cumberland.* Thus the growing season is sensibly reduced from that of the lower parts of the State, and has been calculated to extend, on an average, from April 15th to October 20th in an ordinary season. The shortening of the growing season by two weeks at each end necessarily influences the possible crops, and this is evident to the eye in the increased proportion of oats, decrease in wheat; and the presence of buckwheat as a crop of considerable importance. There are a few natural cranberry bogs from which a small local supply is gathered, and it is from the same or similar wet spots that the finest blue-berries are gathered in the early summer. The forest types also show the influence of the colder conditions, as there are present those trees which are characteristic of the colder sections of the country, Hemlock, Spruce and Tamarack.

In the Zone as a whole there has been but a slight development of the agricultural resources, as compared to the other areas of the state. This is largely due to the prominence heretofore of the lumber industry, in its various phases. As the forest crop is removed

*See Introduction—Climatology.

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it will be more and more possible and locally profitable, to turn to some form of farm practice, for which the individual section may be found particularly fitted. One such line of development which is already in active operations is the raising of hay, both from natural and from planted meadows. Considerable areas of the Mountain soils are suited to the growth of grasses, and are too shallow for satisfactory tillage.

In the broad valley that extends from the Pennsylvania line along the western slope of the Great Back Bone and Big Savage Mountains, a type of valley land has developed known as the "Glades." These are closed valleys of shale soils, having a rim of sandstone. The soft shales have broken down and formed a valley through which a stream of sluggish current runs. The wash from the sides of the valley accumulates along the sides of the stream, forming wet marshy areas slowly rising to the slopes of the bordering hills. The central portion of the "Glade" is thus of wet and cold soil, while the margins may be of a good quality, both as to condition and fertility. It is in such restricted sections that much of the present farming is being carried on and the best types of agricultural soils located.

Agricultural Products.

The chief agricultural products of the State are corn, wheat, tobacco, truck crops, canning crops, and forage crops which are produced under particular conditions which have already been discussed.

Grains.

The leading grains of the State are corn and wheat which are widely produced throughout the State. In the western section oats, rye, barley and buckwheat are likewise produced in limited areas.

Corn.—There are few crops in cultivation that are available in so many ways as is corn, but this is not the place to enumerate the various purposes to which this product of the field is put in the industrial or manufacturing pursuits. Here the agricultural uses are of importance. There are two classes of uses to which the corn crop is ordinarily applied, one being limited to the fresh, the other to the ripe or dry crop. In each of these both the stalks and the ears are

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included, for sweet corn and green fodder are used fresh, while the stock is fed with the ripe ears and with the stover. The different sections of the country and of the State also, make different preparations for the utilization of the crop in the respective ways mentioned. In truck regions the sweet corn is marketed as a vegetable for table use on the cob; at a little distance from the market the same type of corn goes to the cannery and the need for prompt use by the consumer is removed, and the fresh vegetable season becomes extended by the use of the canning process to include the full year. In a somewhat similar way the dairyman may feed his stock with the freshly

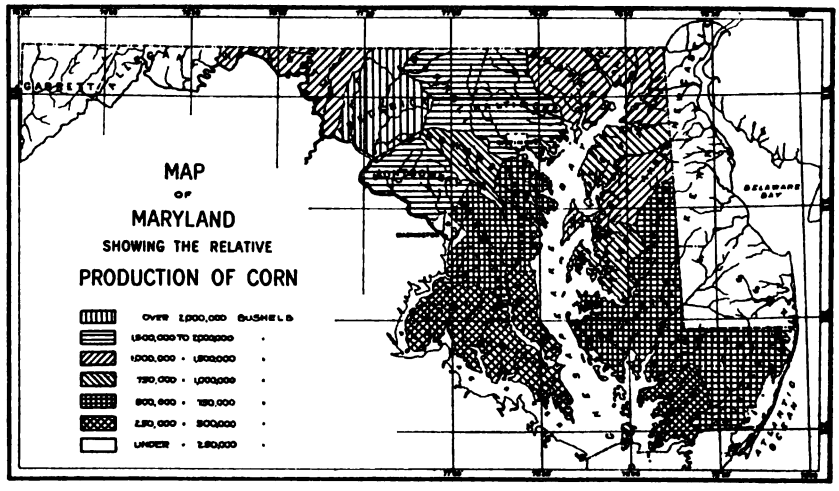

FIG. 10.—Map of Maryland showing the relative Annual Production of Corn.

cut stalks, and the green husks, cobs, and waste ears from the cannery, while fresh, or he may store the succulent stalks for winter feeding by use of the silo, and thereby extend the season of green feed through the winter.

The greatest corn crops are produced in the central part of the State, as will be seen from the map. But the highest yield per acre may easily be located in some other region, as the result of individual farming. The highest average yield per acre, for any one county, was 42.8 for Harford County (1899 figures), while the average for the State was just 30 bushels.*

*The census year was an extremely poor year for all farm products. The average yield of corn for 1905 was 36.9 bushels.

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In the counties in which both green corn for canning, and field corn for harvesting are grown, it is difficult to learn whether both are included in the crop yield figures, or are kept separate as a canning crop and a grain crop respectively.

The counties giving the highest total crop are not identical in rank with those having highest acreage, though the same ones form the highest group of four in each case.

In marketing two customs are evident. In those cases where wagon haul is possible, the corn is usually sold in the ear. But when the railroad is used the shelled corn is shipped, leaving the cobs on the farm. On account of the relatively large amount of mineral material (ash) in the cobs, it would be good farm practice if the farmers would regularly shell their corn, and so sell it. The cobs form an excellent fuel, for quick fires and efficient heat, matching the best of cordwood. The ashes obtained, if kept from rains would be efficient as a top dressing, on account of the potash and phosphoric acid contained.

Progressive farmers find it to their advantage to keep the mineral substances used by their crops, and to restore them to the soil, rather than to lose those elements and thereby diminish the fertility of their fields.

Wheat.—The great bread crop—wheat—is less concentrated than is corn, on the basis of total yield for the county. The deep loams of the Eastern Shore are favorable to the production of large crops, and the level surface renders harvesting easy. The fields there are less frequently disfigured with the bare areas left by the rows of corn shocks than is the case elsewhere in the state.

When the wheat is sown the shock rows are often left, and in the spring in the Midland Zone oats are frequently sown in these spaces, and left to ripen after the wheat has been harvested. Some farmers plant as close as possible to the shocks, driving around them as they come to the shock-row, but this leaves spots entirely bare where the shocks stood, and makes the rows through that portion of the field curved and crossed, an effect not liked by most farmers.

The Coastal Zone has little need for the extensive barns of the other areas, and the barnyard is less important as a feeding and shelter place for stock.

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In the central portion of the State wheat thrashing commonly takes place from the barn floor, the straw being thrown into the barnyard through a narrow high door provided for that purpose; the engine standing on the grade in front of the main door. This secures for the stock a supply of coarse fodder through the winter, also assists in the preparation of the yard compost, by the trampling of straw into the litter of the yard enclosure. In the Coastal Zone the thrashing commonly occurs in the open, and at several points the straw is used in paper manufacturing, rather than as fodder.

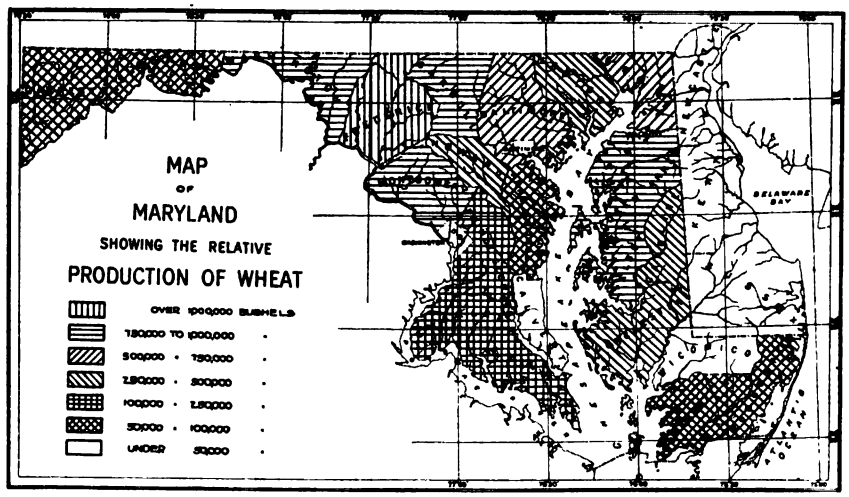

FIG. 11.—Map of Maryland showing the relative Annual Production of Wheat.

This is largely due to the proportionally smaller number of cattle maintained in this area. The use of yard manure is largest in the central portion of the state, where there are numerous farm animals. In the areas of light soils along the Bay there is little manure available, since there are few animals to produce the rich compost of litter from the barnyard. City manure, which is much used in the upper regions along the Bay is less beneficial to the soil than the barnyard compost. The latter is much more retentive of moisture and helps the soil to hold its water supply in a more helpful degree than does the dryer type of manure.

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Maryland is not prominent as an oat or rye producing state, but both of these are raised in every county. Much of the oat crop is an adjunct of the wheat, and is grown in the bare belts left by the rows of corn shocks at the time of wheat seeding. But in the higher land of the Mountain Zone oats are grown in the field, not merely as a filler in the shock rows. Rye is produced in varying amounts through the State, but there is no definite relation between its yield per county and other factors, as soils or climate. The leading county in point of yield is Carroll, where the German love for rye bread is an evident factor.

Buckwheat is raised in small areas through the Midland and Mountain Zones. The total yield is less than half the rye crop, the leading county being Garrett, which in the census year 1899 produced 71,400 bushels, or more than half of the State's crop.

Tobacco.

The tobacco crop assumed so great an importance in the life of early Maryland and its sister colony Virginia, that they are hardly to be considered apart from it, especially if the out-of-doors side of their work is in mind. It was not only the chief crop to be planted, but the one which took most care in the handling and preparation after gathering, and which also was on hand the longest before its value became available for use.

The last feature makes the tobacco crop somewhat like a slow selling stock of a merchant. His capital is tied up for a long time before he can realize upon it through sales. Prices may be of such character as to give good profit, but the risk is large and the idle capital is earning nothing. On the contrary it is constantly requiring more added to it in the way of further care and labor up to the time of sale. While this is true of other crops to some extent, the amount of care and of labor tobacco requires after it has been removed from the field, and the length of time before it is usually sold is greater than in most other cases.

The soils preferred are sandy loams or slightly firmer lands, which can retain the water of rainfall, and also release it to the needs of the growing plants.

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While tobacco is characteristic of the Coastal Zone, a considerable amount is now raised in the region along the lower end of Parr's Ridge, in parts of Montgomery, Frederick and Carroll counties. Here, as the seasons are not so warm as in the lower areas, the barns are adapted to the flue-curing of the tobacco, as is the custom in the Ohio Tobacco region.

Tobacco being a crop which can stand long hauls to market, it has maintained its supremacy in the counties of Southern Maryland where facilities for rapid transportation are less developed, and has

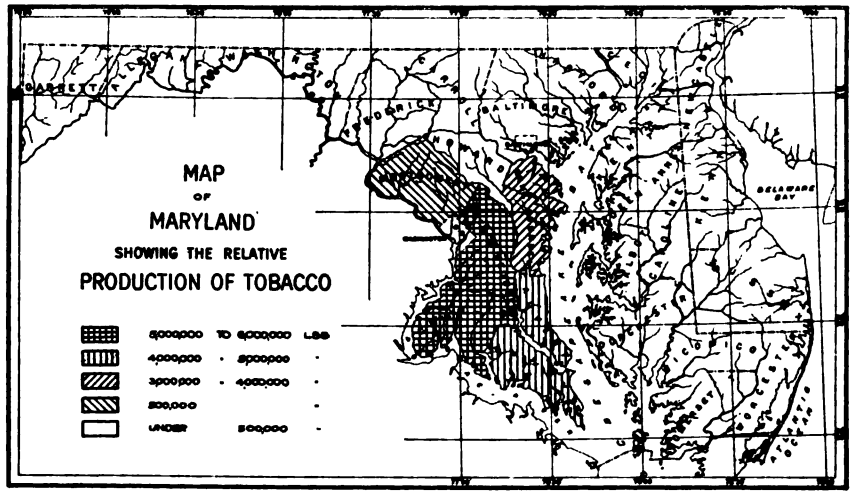

FIG. 12.—Map of Maryland showing the relative Annual Production of Tobacco.

given place to varying degrees to other crops in areas better fitted for prompt marketing of produce.

Truck Crops.

In the Coastal Zone there are to be found the broad fields of corn and tobacco, of wheat also, with fields of strawberries and sweet potatoes in the warm loamy areas. As the vicinity of Baltimore is reached, the area of the single fields of the general crops become smaller, and the various special crops included under the general term "truck," become more prominent. Tomatoes, sweet corn, peas

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for canneries and market, with all the different crops that contribute to the supply of the city dweller, are found in more abundance as the hauling distance becomes less. On the Western Shore the distance from the city at which truck growing is profitable, is in a general way found to be closely related to the distance easily covered by wagon hauling in marketing the produce. Such produce as melons which are brought to the wharves in the quick sailing boats of the Bay, are grown at a much greater distance, and the staple canning crop—the tomato, is extensively grown on the Eastern Shore and shipped to the city by steamer.

The Eastern Shore, as a whole, is much more of a small fruit or truck region than the Western Shore for the presence of good railroad transportation to the northern markets in addition to the steam and sailing vessels assure the grower probability of prompt marketing. The water-carried produce usually goes to Baltimore; the railroad transportation is mostly to the cities farther north (Philadelphia and New York). The commission merchants of these cities send their buyers into the truck and especially the fruit regions of the State, and buy the crops of the growers at the farm in many instances. This is quite commonly done upon the Eastern Shore, and in the apple area of the western part of the State, and is of benefit to the grower in that he has his market come to his goods instead of having to send the goods to the market. The level nature of the Coastal Zone, and the deep rivers penetrating the land far back from the Bay, assist materially in the development of the region as a truck and fruit section.

Of the truck crops, tomatoes lead in acreage and yield, with sweet corn second. Cabbage and melons are next in importance, but the method of recording the crop is quite different in the two groups. The first group, tomatoes and corn, are recorded in bushels; the second, by the individual unit, head of cabbage or single melon. Peas and beans are quite important as truck crops, but just what proportion of the yield should be credited to the truck and which to the canning list is difficult to determine. It is quite possible that any given load of produce might be raised as a truck crop, but through the various channels of trade finally reach the consumer as canned goods.

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Strawberries may be discussed as a truck crop more conveniently than as a fruit, since it is also a canning crop. The chief strawberry areas are in the sandy soil of the Coastal Zone. The crop from the Eastern Shore is delivered to the northern cities, Philadelphia and beyond, while the Western Shore berries more largely supply Baltimore and Washington and Pittsburg. This is in direct relation to the lines of communication established in the respective areas. The markets are in general supplied from the nearest source of straight shipment, as every handling adds to the cost of transportation, and to the risk of loss to the grower. Together these add to

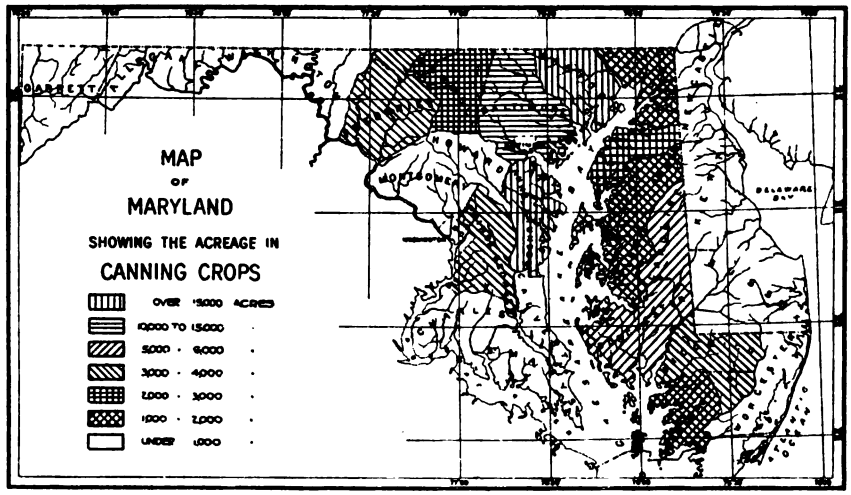

FIG. 13.—Map of Maryland showing the acreage in Canning Crops.

the price which the consumer pays for his berries under normal conditions.

Of the other berries which are grown for market, the total crop is comparatively small, and does not figure in the State's business as does the strawberry crop.

Anne Arundel County leads in strawberries, and in sweet potatoes also. Baltimore county is first in white potatoes and in onions. The total crop of sweet potatoes is about one third that of the white potato crop.

Canning Crops.—The canning industry is one of the most important branches or adjuncts of Maryland Agriculture. The farmer

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in the Coastal Zone by his contracts for tomatoes knows his possible income in advance, and does not have to seek an uncertain market. The contracting feature does not assume so prominent a factor in regard to the pea and corn canning, but in each of these there is a nearby market assured the producer who supplies the canning factory. The chief corn canning area is in the central Midland Zone, the other two crops, tomatoes and peas, are characteristic of the warmer soils of the Coastal.

Baltimore being a market centre draws upon distant as well as local sources of supply. This is noticeable in the canning industry. Peaches form an important part of the year's output from the city factories, the fruit being either consigned to the canneries, or bought in the open market. Strawberries are not regularly canned to an important degree, but at times of glutted markets they are so treated. A modification of ordinary canning is found in the preparation of fruit juices for use in summer drinks. Much of the strawberry fruit juice so used is secured in the Baltimore markets through the canning factories.

Apples and vegetables, such as sweet potatoes and beans, are put up under special conditions, but such special lines have not been developed much beyond the point of filling in otherwise idle time between regular crops.

The relative acreage in canning crops in the several counties may be seen from the map on the opposite page. It serves also for a trucking map, as the two industries are closely related in their development.

Fruits.

In the earlier days of fruit growing the Eastern Shore joined as one agricultural unit in the production of the "Delaware Peaches" which still figure largely in the markets of the upper Atlantic cities and in the adjacent interior regions. Much of the actual peach production however has been transferred from the Coastal Zone to the Midland, and is even passing beyond into the Mountain Zone area, in the latter case beyond the limits of our discussion into West Virginia. The incurable disease of the peach known as "Yellows" is largely responsible for the shifting of the peach industry, as when

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its activity destroyed the productive orchards in one place the business was developed in another, to meet the demand from the markets dependent upon the State for their supplies of this fruit. The Yellows has followed the movement of the commercial orchard areas, and the industry in other parts of the State is threatened. The importance of destroying the trees as soon as there is a sight of disease is now recognized as essential to its control, and the more thrifty growers do so as part of the season's work.

Under present conditions the region about the upper end of the Blue Ridge is important in the fruit industry; and it is in this region that the "Mountain Peach" as a product of Maryland was developed. The varieties which have the word "Mountain" as part of their name are not confined to the high ground, as both the light fleshed Mountain Rareripe, and the Mountain Rose, are or were grown on the low elevations of the Delaware-Maryland Peninsula. The qualities that made the Mountain Peach so well known were probably due to the conditions of growth, just as is the case in the growing of apples, proper regard being used for suitable varieties for growth.

The character of ground used for the planting of orchards of either peach or apple, is preferably recently cleared woodland, and there is a cultivated crop, of corn usually, grown among the trees during the first years after planting, before the trees come into bearing. Afterward it is the practice among the best growers to cultivate during the early part of each season, and sow some form of clover or cow peas to cover the soil during the ripening period and before the winter sets in to turn this growth under to decay as a source of the next season's nitrogen. Where the season is open and much rain is expected, the late plowing is often deferred until spring, the plants acting as a protection against washing.

Grapes are grown extensively in the Blue Ridge section of the State, but do not take so prominent a place in the fruit markets as do the peaches. The large Italian or Japanese Chestnuts are grown to a considerable degree on the woodland slopes of the Pen Mar region, where the sprouts which grow from the cut stumps of the native chestnut are grafted with the large type and an early bearing orchard of the nut trees results. One great advantage of thus de-

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FIG. 2.—VIEW SHOWING SANDSTONE BOULDERS IN RIDGE FOREST WITH CHESTNUT, PURPLE FLOWERING RASPBERRY AND TIARELLA, NEAR SWANTON, GARRETT COUNTY.

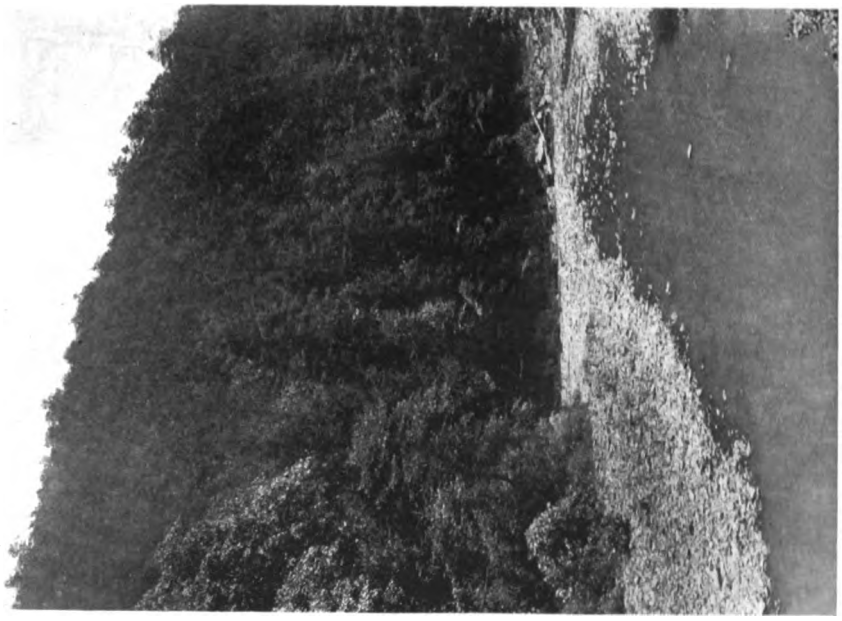

FIG. 1.—VIEW SHOWING FOREST OF HEMLOCK, PITCH PINE, CHESTNUT AND TULIP TREE, SIDELING CREEK, WASHINGTON COUNTY.

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veloping an orchard lies in the presence already of an extensive root system on the part of the native tree whose stump-sprout is used for the stock into which to graft the foreign scion. A difficulty the growers have to meet is that the early opening of the burrs allows insects, like the wevils, to reach the young nuts, and by laying their eggs in them make them wormy and unsalable. Methods of control are coming into use by which this loss may be diminished.

Working upon the supposition that soil which has supported a crop of wild deciduous trees will maintain a cultivated crop of trees also, the ridges in the higher parts of the Midland Zone have been planted to apple orchards; the headquarters of the industry being in the region near Hancock, near the western end of Washington County. The conditions here approximate those of the celebrated apple regions of New York, the extremes of the climate not being reached here however. This is a comparatively new form of fruit growing in this section and has not yet reached its full development; many of the orchards being too young as yet to produce commercial crops. As the production increases it seems quite possible that Maryland will become known for its apples as favorably as it now is for peaches and strawberries.

Just beyond Hancock a section of good farming country is to be found in several broad ridges and corresponding valleys which are in some cases too steep for easy tillage. These are often set out in apple orchards, the acreage in this section being very considerable and on the increase. The older orchards are now coming into bearing. As in the case of the peach, the preference is for land that has recently been in timber, and one may see in some of the orchards the waste from the lumbering still lying where it was left at the time of cutting. Some of the hillsides afford pasturage to the Angora goat, or to sheep, both of which especially goats act as forerunners to the orchard through their ability as clean feeders. The goats secure the necessary pasturage from the sprouts and undergrowth, killing the undesired shrubbery about the orchard area; afterwards they are removed, and the trees planted with a certainty that much of the growth of woody shrubs, that often continues for several seasons under other conditions, will not interfere with the work in hand. This ability of the goats depends upon a proper propor-

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tion of animals to the area to be cleared; there should be enough animals to feed upon the shoots as fast as they develop and by successively eating off the shoots as they are renewed, the plants are soon killed through the constant loss of all leaf surface, without which in some form no plant can long remain alive. The roots of these dead shrubs soon decay, and the field is thereby the more easily cared for. The long hair (mohair) of these goats is a valuable addition to the revenue of the farm, and comes in as almost clear profit so far as cost of food is concerned.

One feature concerned in the clearing of the slopes, and planting to orchards, lies in the resulting washing of the soils. Under the modern method of cultivation of commercial orchards, the soil is bare during the season of the early summer when the rains are often heavy and driving. Under clean tillage the soil is easily washed away in such a rain-fall and gullying results. The time since the orchards were set out is too short to be able to make any statement as to injury actually done, but this is certainly a source of loss to the orchardist, through the removal of the better portions of the soil near the top, as well as to his valley fields upon which the debris and waste of the steeper fields are washed. Some keep a strip of some kind of green plant, cow-peas, rye, or other quick growing crop, in the space midway between the rows of trees through the season when the cultivation is going on, this being turned under and the whole planted to a quick growing crop about mid-season. The exposure of the whole surface is thus materially reduced, and the conditions of washing and gullying thereby lessened.

Forage Crops.

One of the important sources of forage is found in the leaves and stalks of corn.

The dry stover is prepared in two ways; either by "pulling blades" and "topping," which is most common in the Coastal Zone, or by "cutting corn," as is commonly practised in the other Zones of the State.

The method of saving fodder by the former system is thus described by one who is located upon a large farm in Worcester County; the details may be slightly different elsewhere. The description is

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inserted to show the amount of labor involved in the method, as compared to the other methods, i. e., cutting the stalk at the ground and shocking, or running the whole plant with or without the ears, through shredding or chopping machines.

Three men together work down two rows, the first man cutting tops, and the two following him pulling blades. The tops from eight hills are thrown together as the men take the two rows and on the return trip the tops from eight other hills are added to the pile making a "stoop" of 16 hills. The blades have been pulled by the strippers and made into "bunches" which are tied with a blade of fodder and hung upon the standing portion of the stalk to cure. The next step is to tie up the tops which have been lying in the "stoop" for a day. Two or three of these are tied into a "tie" or bunch, using a tough stalk for the purpose, thus putting tops of 32 or 48 hills together, according to the rankness of the fodder; these three "ties" are stood together to cure until time to stack. In stacking, 100 bunches or "ties" are set up first, being built about a center pole; on the top of the tops which thus act as a foundation the blades from the same stalks are added, the whole arranged to shed water like a thatch roof. With one hundred ties to the stack, there are 4800 hills accounted for in each stack, or a square of nearly 70 hills to a side. The men each receive 10c to 15c per hour, and put in ten hours as an average day.

In thus gathering fodder, the ground is gone over several times, once to cut tops and strip blades, again to gather these into "ties" and to put the "ties" into trios of three ties each, to cure. A third trip over the ground is required in collecting these "trios" into the final stacks of 100 ties. The entire field must be gone over three times with no account taken of the short steps required in collecting the material into the successively larger units at the different times.

As a substitute for hay this type of fodder is perhaps better than the others, especially for horses, as the coarsest portions are left in the field, but the hand labor involved is comparable to that required to gather grain by cradling instead of by some of the horse-power reaping machines.

The ears may be husked from the standing stalk, or as is more often the case, broken off and husked at leisure, often with pleasure

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attendant, as at "husking bees." The stalks and what may be left of the husks or blades, are usually left to be turned under in the spring and afford some exercise to stock during the outdoor weather of the winter months.

In "cutting corn" the procedure is more simple, and the utilization of the fodder is more complete. The essential difference lies in the cutting of the stalk close to the ground, with the blades, ears, and top in place, and curing the whole plant in shocks, as were the tops in the first method. In this method the field is ordinarily planted promptly to wheat, the corn rows being disc-harrowed or otherwise loosened for the sowing of the grain, and this is in the ground before the corn is husked from the shocked stalks. The fodder is in this case usually fed to the cattle only, the other stock having hay in the more common cases. The fodder is usually thrown into the barnyard, or into a pasture field, and the cattle soon strip the blades and other edible parts tramping and breaking the rest as they move about. In the yard this is helpful in the general preparation of the compost, but when fed in the field there is nearly complete loss in utility of the coarser parts.

The use of self-binding corn harvesters is not so common in this state as in some of those farther West, but they are often used where the corn is to be stored in a silo. The harvester makes bundles of a size convenient to handle at the cutting machine, and works more rapidly than hand labor. It is possible to cut silage direct from the field by the use of the harvester, which cuts about as fast as the bundles are hauled to the barn and fed to the silage cutter. The corn is usually harvested for this purpose when the kernels are past the "milk" condition and becoming mealy when cut by the thumb nail.

Siloes.—The use of siloes is so much more customary now than a few years ago that it is hardly necessary to describe the construction of them. The common type is the "stave silo," located just outside the barn, and rising to about the same height as the eaves. The essential point in these, as contrasted to the older pit or stone siloes lies in the entire absence of corners, and the possibility of keeping the structure tight by the long screw rods which, like hoops of a barrel, are placed at intervals about the cylindrical tank which forms

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the silo of this type. A cement foundation is provided to assure a firm base and the rest is built of lumber, dressed on the inside at least, if not on both sides. No rough points, or corners are left, and the finely cut ensilage is packed well against the walls, well distributed elsewhere, and any holes or spaces carefully guarded against, contact with the air being the danger to be avoided, as spoiled silage results. The loss from this cause in a well packed, and tightly built silo, is not usually more than the top eight to twelve inches, and after the silage is ready for use, the injury rarely extends further.

By the use of ensilage the entire corn plant is utilized, except the lowest six or eight inches of the stalk which are left as stubble, and the richness of fresh fodder is largely preserved. To a less degree the feeding value of the dry stalks may be retained through the use of the various shredding machines, and feed cutters. These tear and chop the stalks and attached blades, husks, and ears if there are any left, into pieces so small as to be easily eaten by cattle with almost no waste. The shredded fodder is almost ideal bedding material, as its absorbing power is very great, and its fine condition makes its distribution as bedding and later as compost, much more convenient than is possible with coarse litter. There are machines on the market which will take loose bundles of stalks and reduce the stalks and blades to shredded fodder, and at the same time husk the ears, throwing these to one side; however, there does not seem to be much call for these in this State, none having been seen in use during the past two seasons.

Cost.—The practice of "pulling blades" as the method first described is often called, is a common but expensive one. The rate paid for the labor necessary to gather the fodder makes the bulk equivalent of a ton of timothy hay cost as much as the hay itself. In some localities it is the custom for men or boys not otherwise occupied at the time to hire out to "pull blades" at a rate of a dollar a day, and to spend a considerable time in this work. The rate paid is sometimes reckoned on the quantity prepared, especially if done in part on shares, the basis being the amount which is gathered into the piles or shocks which have been mentioned, and which

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form the means of calculating the fodder yield of the crop. The custom is one that requires a great amount of time for the return received. Most of this is saved in the process of ensilage making. The use of the corn harvester is of value in cutting the ripe corn just as much as in gathering for the silo, and this reduces the amount of travel over the same ground to a large degree and much of that which is still necessary is done by draught animals rather than by laborers on foot. It is thought by some that the quality of the corn from topped fields is not so good as that from adjacent fields in

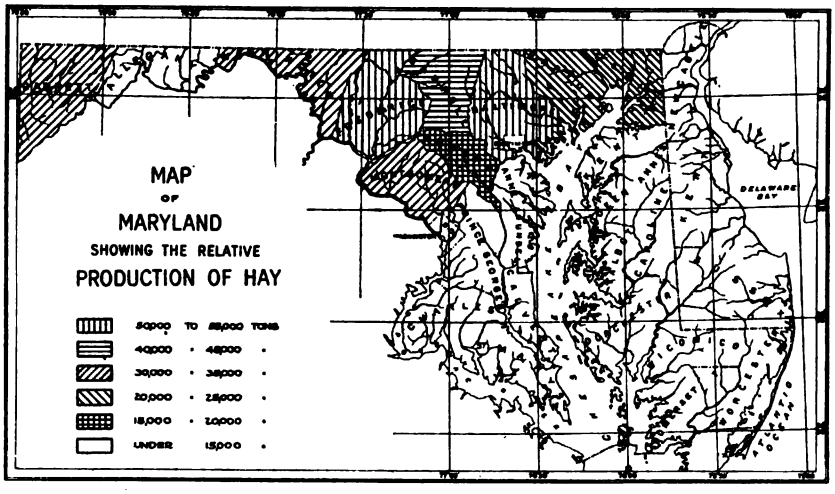

FIG. 14.—Map of Maryland showing the relative Annual Production of Hay.

which the entire stalk was cut at the proper time, both ripening in the field in the manner customary in the respective cases. The differences were found through careful analyses, and while hardly enough to influence ordinary feeding uses, might be of considerable influence in the seed quality of the corn for the next crop.

The several methods of utilizing the corn crop are somewhat characteristic of the several Zones of the State; the top-and-blade gathering being largely prevalent in the Coastal, while the use of the siloes is most common in the Midland Zone. The use of the stover or whole fodder, is common in the upper part of the Coastal, and in both Midland and Mountain Zones, the areas overlapping in this feature more than in the other two, but the limits are not sharply drawn for either.

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Hay.—As might be supposed, the soils that are favorable to the dairy industry are also well suited to the production of hay, and in the sections too far from transportation to make the shipping of milk a profitable business the raising of hay for sale in the baled form or loose, becomes of importance. The higher areas of the Midland Zone, and some portions of the Mountain Zone are important factors in the hay supply of the Baltimore and Washington markets.

There are some natural meadows from which commercial hay is cut, but more frequently this wild hay is used at home. Most of the hay sold is that from the clover-timothy steps in crop rotation, as these are a standard in the market. Incident to the production of hay comes the production of seed for the replanting of the crop. Both clover and grass seed are raised to some extent in this State, although neither becomes of great importance in the general market.

Dairying.

Dairying has become an important element in the State's agriculture, and this is found to be directly related, according to present methods, to the soils of the several sections. It has been expressed in saying that "one cannot raise milk where the blue-grass does not grow naturally." This means that in those parts of the State in which the native grasses do not form a turf, as does the blue-grass, there is little use in raising dairy cattle; for the absence of pasturage is in most cases a determining factor against the production of milk in commercial amounts. It will be seen from the maps on pages 348 and 350 that the Coastal Zone is very largely in the area of unfavorable soil conditions, hence lying outside the present dairy area.

If, however, the present methods should be changed, so that the use of large fields for pasturage would be unnecessary, the food material being secured in some other way, as by fodder crops, soiling crops, or ensilage, the profitable limits of the dairy area could be extended to include some of the lighter loams not now available for such purposes.

Some people have objected to the use of ensilage because of the possible flavor the milk might receive from the feed. It has been found that if the ration of silage be given immediately after milking instead of before or while milking, there will be no flavor im-

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parted to the milk from the food, and the full benefit of the succulent milk producing material will be received.

The greatest development of the dairying industry is of course in regions convenient to the large cities, where the milk can be delivered promptly by the railroads. The presence of towns of considerable size in the central part of the State helps to distribute the milk industry over a broader area. The natural pasturage which prevails in the northern part of the State is an important factor in the success of the dairy farmer.

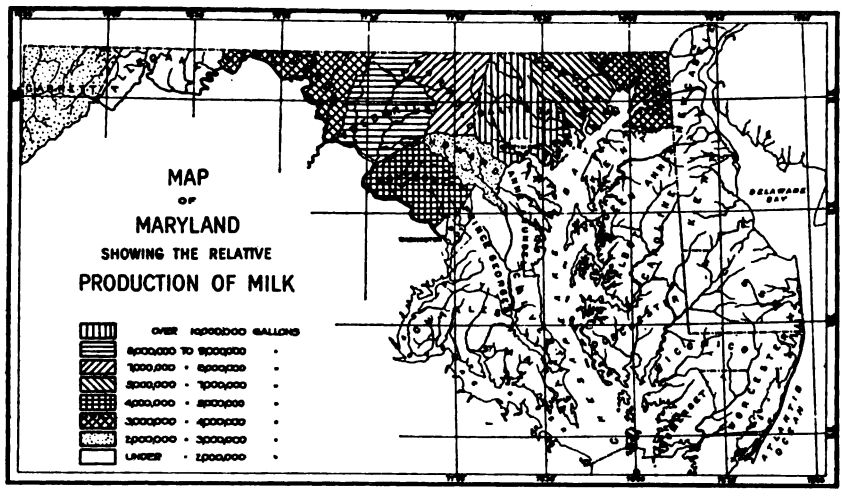

FIG. 15.—Map of Maryland showing the relative Annual Production of Milk.

The sale of milk removes comparatively little fertility from the farm, as the chief components of milk are similar to those of green plants; i. e., water and carbon compounds which contain but little ash or mineral matter. By keeping the other produce on the farm for home consumption, the general fertility of one's land would increase rather than decrease from time to time.

Farm Animals.

Through the region of firm soils which favor the dairy industry, there is an accompanying line of agriculture closely related to it in many ways, the feeding of beef cattle. It is the practice of many farmers to buy cattle of the beef type in the fall, stall feed them

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FIG. 1.—VIEW SHOWING THE EDGE OF SECOND GROWTH SWAMP FOREST WITH BLACK SPRUCE AND TAMARACK, NEAR THAYERVILLE, GARRETT COUNTY.

FIG. 2.—VIEW SHOWING SECOND GROWTH SWAMP FOREST WITH BLACK SPRUCE, RED MAPLE AND RHODODENDRON, NEAR FINZEL, GARRETT COUNTY.

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through the winter and in the spring sell for the export trade. Other farmers where pasture is abundant carry their steers through the winter on the coarse forage of the farm, fatten on pasture during the summer and sell as "grassers" in the fall. The careful farmer thus gains in two ways by the increased valuation at time of sale, and by the accumulated fertility during feeding time, which is of no little permanent value in the upbuilding of the farm's capacity for crops. In case the farm is located in convenient relation to corn canning factories, the waste from the cannery—cobs, husks, refuse ears, etc., is often secured by the growers and fed either fresh to dairy or as ensilage to both dairy and beef cattle. This particular feature may be found around Westminster or Frederick, both being important centers in each of the three lines mentioned, dairy, canning and beef raising.

The "Glades" that occur in the Mountain Zone were important natural pasture lands before the separation of Garrett from the older Allegany County. Their pasture character is still important, as the firm deep soil with usually a sufficient supply of moisture, is well fitted to the growth of the grasses of the pasture type. Both sheep and cattle are raised in these areas, and they also afford naturally favorable conditions for hay raising.

The raising of sheep is developed to a considerable business in the two extremes of the State, the Mountain Zone and the Eastern Shore District of the Coastal Zone. The counties in which there are any considerable number of sheep are Garrett, and the three counties from the Sassafras to the Choptank,—Kent, Queen Anne's and Talbot, the loam soils of these areas giving good pasturage for grazing.

Other animals which are important in Maryland, are pigs and horses. The former are raised in small numbers quite generally over the State, but the pasture counties of the Midland Zone are the ones where horses are produced.

Rotation of Crops.

Crop rotations have much to do with the general maintenance of fertility of the farm lands, and the particular rotation practised is found to be quite different in the several sections of the State. In

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general the plan is best developed from the theoretical standpoint at least, in the Midland Zone, where the soil conditions make possible a choice of several types of crops which may be grown in such order as to form a beneficial succession on a given field.

The theory of crop rotation is that a continued cropping of one kind of plant in some way diminishes the available supply of the particular elements of soil fertility which that plant requires in greatest degree, this loss being met and counteracted by introducing other crops which add available plant food to the soil or at least draw upon the soil materials in different proportion from the first crop. Whether the effect is exactly as stated or not is of secondary importance here, the point being that a succession of crops average better than a long continuance of a single one, upon a given area of land. Most farmers practise some type of rotation, and the choice of successive crops varies with the section of the State in which the farm may be located.

Rotations of the Midland and Western Zones are based upon the maintenance of each field for at least two seasons in a clover and timothy sod. In the Midland Zone the typical rotation may be taken as starting with corn; this is usually followed by wheat in the fall of the same year. After the wheat is off, the stubble is usually plowed, and after a period of fallowing, often omitted, may be again sown in wheat, with timothy and clover, the former seeded with the wheat, the latter the following spring. The field is allowed to remain in hay for two years, being pastured to some extent after each mowing. After the second year of hay, the sod is usually turned under and corn comes again as the next crop.

In case the farmer has a permanent pasture to develop at intervals, it is usually done as the natural outgrowth of the hay field, the use as pasture coming in as the yield of hay diminishes after a few years of cutting. In those sections where the pastures are natural and do not need to be planted the hay fields are pastured only sufficiently to keep down a too luxuriant aftermath.

The conditions in parts of the Coastal Zone are such that the clover item is often omitted, on account of the difficulty of securing a crop of this plant. In some cases cow-peas or other legumes of similar type are substituted for the clover, or in a growing number

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of cases, alfalfa is the crop planted. The particular form of legume must be selected to suit the local conditions of soil and climate. Tobacco comes into the rotation in the section of the Zone along the western shore of the Bay, and in the rotation as given above it may be considered as substituted for the hay crop of the cycle, reducing the rotation to three instead of four years; corn, wheat, tobacco, being the order in this case, while corn, wheat, hay, hay was the order before.

The introduction of such crops as potatoes, into the general farm rotation or of the several truck and canning crops in the truck areas, causes a variation from the rotation order as outlined. This has more or less importance as the area of the field is wholly involved or only a portion of it receives the special crop. In the truck areas the regular rotation of staple crops is less apparent, as the land is under more continuous cropping and practically every crop receives its share of fertilizer or manure. In the effort to keep the land in crop the truck farmer rarely alternates the type of plants grown to a degree sufficient to meet the theoretical conditions for rotation suggested above. The trucker has this advantage over the regular farmer,—much of his produce is green vegetation, as lettuce, spinach, cabbage, etc., comparatively little developing to the point of ripe seeds, as is the regular thing with such crops as corn and wheat. It is the latter type of crop that is hard on the fertility of a field, because of the amount of phosphoric acid taken in the ripening of the seeds. Green crops take very little of soil fertility from the land, for the solid substance is largely derived from the air as carbonic acid, and built into the cellular tissues of leaf or stalk, the cells being filled with the juices of the plant, or with such other material as starch, of a similar character to the cells themselves, as regards composition. Such crops withdraw but little fertility from the soil, as one can determine for himself by comparing the amount of ashes left by a few pounds of cabbage or lettuce or some fresh fodder crop with that left by the same weight of wheat or corn.

There are other sources of loss in the fertility of one's farm land, and one of these is the gullying and washing of plowed ground.

When it is desirable to cultivate fields having steep slopes the method of plowing known as "contour plowing" can be used to ad-

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vantage. In this method the furrows are run around the hill instead of up and down the slopes. Each furrow thus acts as a terrace to check the rush of water, and by retaining the first accumulation permits a longer period for soil absorption. In a moderate rain such check to the beginning of the rivulets may prevent the washing, and the field thus escape serious cutting or gullying for a considerable time. The damage done by washes in the fields may be seen to some extent on almost any slope in Southern Maryland, the Midland Zone, or in the higher land westward. The damage is done not only by the carrying away of the soil from the field which is cut and gullied, but the lower fields and meadows or pastures are to an often serious degree injured by the deposition of the transported material. While the damage by sudden bursts of extreme rainfall, can not be avoided, the amount could be decreased, and in normal rains materially reduced by a little more care in methods of tillage, and of selection of fields for cultivation.

Agricultural Statistics.

The figures given in the following tables are taken from the United States Census for 1900. The details there available are more complete than in other sources at hand, and their value for comparison is not lost by the passing of a few years. The actual figures would vary considerably from one year to another, according to climatic factors, but the relative amounts would not be subject to such immediate fluctuations. Thus the amount spent for Labor and for Fertilizers in the several counties will not be the same in any two years. But the amount spent in Baltimore County will not vary much as compared with the amount spent in Calvert County in the same year.

It will be noted that those counties which rank high in expenditure stand high also in values of produce. Another comparison quickly made, is between the values of farm buildings in the different counties, high total values being associated with those counties which are so situated as to require winter shelter for crops and animals. By comparing the value of Farm Implements for different counties, the type of farm practice may be judged in a general way.

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TABLE I. NUMBER OF FARMS AND ACREAGE OF IMPROVED LAND.

Counties	Acres	Acres Improved	Av. Acres Per Farm	No. of Farms
Allegany	160,348	75,905	179.4	894
Anne Arundel	206,967	148,325	109.6	1,889
Baltimore	340,206	244,806	75.7	4,496
Calvert	136,625	88,605	126.9	1,077
Caroline	183,501	125,908	98.5	1,863
Carroll	276,593	227,693	82.6	3,352
Cecil	200,629	141,401	122.9	1,633
Charles	263,255	153,465	138.6	1,900
Dorchester	243,497	128,160	121.3	2,007
Frederick	374,381	308,041	99.9	3,747
Garrett	243,510	123,932	136.2	1,788
Harford	248,925	174,255	102.4	2,431
Howard	146,039	110,546	120.3	1,214
Kent	169,288	138,944	179.9	941
Montgomery	283,469	212,840	136.0	2,085
Prince George's	265,003	174,273	111.6	2,374
Queen Anne's	224,143	173,396	153.9	1,456
Saint Mary's	192,503	109,553	149.0	1,292
Somerset	144,970	82,650	95.3	1,521
Talbot	164,792	119,266	137.4	1,199
Washington	249,221	197,948	104.1	2,393
Wicomico	207,284	122,453	89.6	2,314
Worcester	241,434	132,549	121.5	1,987
Total	5,170,075	3,516,352	112.4	46,012

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TABLE II. VALUATIONS OF FARMS AND THEIR EQUIPMENT.

Counties	Land	Buildings	Tools, &c.	Labor	Fertilizers
Allegany.....	$1,945,000	$ 669,940	$ 136,730	$ 58,600	$ 16,480
Anne Arundel..	3,659,970	1,885,740	275,470	331,670	183,970
Baltimore.....	23,190,670	9,295,710	1,235,380	866,030	313,560
Calvert	1,546,070	659,100	100,840	66,820	46,480
Caroline	2,874,970	1,051,050	243,080	125,240	93,290
Carroll	7,210,730	4,501,850	719,340	336,560	160,000
Cecil	4,773,490	3,024,820	440,610	301,840	146,430
Charles.....	2,775,240	1,216,610	191,650	68,240	48,500
Dorchester.....	2,761,440	1,087,720	218,740	138,960	76,800
Frederick.....	12,394,570	5,645,840	855,380	502,250	190,560
Garrett	2,900,670	992,210	226,210	63,600	23,220
Harford..	5,519,510	4,160,360	570,600	372,010	272,960
Howard.....	3,494,690	2,275,470	321,990	217,660	108,410
Kent.....	4,258,300	1,365,050	276,780	303,010	112,500
Montgomery....	9,491,930	3,525,170	576,010	418,060	198,370
Prince George's.	5,710,630	2,577,410	323,820	263,210	74,310
Queen Anne's..	4,558,610	1,590,780	384,780	288,880	130,330
Somerset.....	1,622,690	995,000	157,020	131,070	42,030
Talbot	4,200,570	1,690,700	304,220	241,480	89,040
Washington....	8,223,320	3,552,060	516,250	309,750	111,540
Wicomico.....	1,923,360	882,320	171,640	79,380	60,560
Worcester	1,978,540	878,290	173,400	72,360	52,490
Total	$120,367,550	$54,810,760	$8,611,220	$5,715,520	$2,618,890

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TABLE III. ACREAGE AND CROP YIELDS OF GRAINS BY COUNTIES

Counties	Corn		Wheat		Oats		Rye	Hay	
	Acres	Bushels	Acres	Bushels	Acres	Bushels	Bushels	Acres	Tons
Allegany.....	8,029	171,530	6,895	73,000	3,062	64,250	11,680	8,222	8,844
Anne Arundel.	25,634	582,400	6,800	63,920	699	11,010	1,700	3,262	3,468
Baltimore.....	38,447	1,530,990	36,486	536,290	5,785	142,950	55,530	47,940	50,803
Calvert.....	11,848	275,690	3,181	33,050	448	5,330	2,020	243	328
Caroline.....	26,306	672,520	24,509	331,480	208	3,000	1,970	8,181	7,472
Carroll.....	39,880	1,660,340	58,097	808,180	3,251	94,740	86,910	41,753	46,055
Cecil.....	26,132	1,026,010	31,358	559,860	5,302	157,120	440	23,457	22,611
Charles.....	22,391	447,170	10,360	115,250	315	4,040	2,770	2,068	2,246
Dorchester....	28,731	654,360	21,969	313,130	271	4,590	1,290	4,450	5,347
Frederick.....	57,484	2,279,040	92,620	1,314,280	2,946	76,310	30,970	20,386	54,446
Garrett.....	5,690	169,150	3,037	57,540	10,336	290,160	15,540	26,405	29,832
Harford.....	24,627	1,056,980	22,935	332,590	4,456	122,380	1,510	26,201	26,420
Howard.....	19,885	782,680	25,941	416,570	578	11,650	10,480	16,417	16,324
Kent.....	29,376	982,350	42,373	817,120	325	4,770	80	7,364	5,269
Montgomery..	40,030	1,489,760	48,436	776,280	508	12,040	28,150	32,559	34,095
Pr. George's..	28,776	676,930	10,550	104,110	1,044	18,760	8,800	5,800	7,158
Queen Anne's.	36,973	1,130,740	55,278	972,640	258	4,580	830	4,100	4,069
Saint Mary's..	20,705	392,830	15,008	175,580	77	1,120	820	1,924	2,430
Somerset.....	23,363	441,540	6,604	95,860	699	10,910	440	4,813	6,777
Talbot.....	21,997	807,680	42,853	846,340	90	1,990	190	6,301	6,332
Washington...	37,526	1,201,250	59,955	829,700	1,132	26,040	9,440	29,551	35,215
Wicomico.....	40,550	582,960	3,282	41,110	212	3,030	1,140	2,996	3,400
Worcester.....	43,464	714,890	5,735	71,420	2,557	37,960	560	4,515	5,373
Total.....	658,010	19,766,510	634,446	9,671,800	44,625	1,109,560	279,550	357,224	386,768

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TABLE IV. DAIRY INTERESTS.

Counties	Dairy Cows	Other Cows	Steers	Stock Value	Milk Gallons Produced	Butter Pounds Produced*	Produce Value
Allegany	2,763	400	466	$ 338,974	1,013,108	183,300	$ 113,577
Anne Arundel	2,738	162	198	598,679	973,188	152,593	118,781
Baltimore	18,045	781	385	2,259,295	10,370,504	1,075,274	1,103,039
Calvert	1,713	84	218	306,412	480,375	35,775	50,042
Caroline	3,572	176	77	579,514	1,351,051	260,683	88,883
Carroll	14,186	265	403	1,210,730	7,690,576	1,258,700	527,957
Cecil	9,056	356	354	984,644	3,641,790	484,790	241,230
Charles	3,474	223	718	578,543	812,086	133,555	70,487
Dorchester	3,992	615	336	628,417	1,159,085	158,372	79,744
Frederick	17,473	570	1,937	2,160,795	8,745,300	1,493,740	525,672
Garrett	5,994	1,097	1,881	822,072	2,176,704	420,883	172,702
Harford	10,291	339	2,030	1,460,396	5,268,218	566,243	426,690
Howard	4,495	121	658	676,286	2,276,540	459,873	171,077
Kent	6,139	474	75	774,715	1,800,378	136,027	105,019
Montgomery	8,738	449	1,926	1,486,558	4,214,832	320,835	450,230
Prince George's	3,982	312	220	712,118	1,674,568	215,393	188,488
Queen Anne's	6,837	334	96	1,049,553	1,549,988	173,545	89,568
Saint Mary's	2,613	173	488	450,554	622,063	107,538	54,503
Somerset	1,730	211	115	381,843	580,653	111,714	51,051
Talbot	4,470	321	104	759,581	1,333,438	172,370	86,346
Washington	8,032	342	901	1,221,620	3,733,544	793,073	231,131
Wicomico	2,429	143	137	469,069	963,856	187,881	79,273
Worcester	3,375	1,450	344	589,658	1,003,070	182,315	94,846
Total	147,284	9,490	14,068	$20,855,877	64,040,517	9,096,662	$5,228,698

*Amount marketed 5,828,684 pounds.

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TABLE SHOWING ACREAGE OF TRUCK CROPS.

Baltimore District:	
Anne Arundel County	15,946 acres.
Baltimore County	11,843 acres.
Carroll County	2,060 acres.
Harford County	16,750 acres.
Howard County	670 acres.
	47,169 acres.
Eastern Shore District:	
Caroline County	5,721 acres.
Cecil County	1,607 acres.
Dorchester County	5,328 acres.
Kent County	2,495 acres.
Queen Anne's County	1,530 acres.
Somerset County	1,303 acres.
Talbot County	1,887 acres.
Wicomico County	3,718 acres.
Worcester County	591 acres.
	24,180 acres.
Scattered:	
Frederick County	3,056 acres.
Garrett County	6 acres.
Montgomery County	201 acres.
Prince George's County	3,507 acres.
St. Mary's County	350 acres.
Washington County	332 acres.
	7,452 acres.

TABLE SHOWING PRODUCTION AND ACREAGE OF TOBACCO.

	Lbs.	Acres.
Allegany County	140	....
Anne Arundel County	3,350,250	6,067
Baltimore County	3,160	6
Calvert County	4,768,180	10,137
Carroll County	65,300	83
Charles County	5,584,560	9,002
Dorchester County	3,000	3
Frederick County	125,330	161
Harford County	73,690	70
Howard County	89,680	115
Montgomery County	431,960	553
Prince George's County	5,542,080	10,466
St. Mary's County	4,551,350	6,244
Wicomico County	200	1
Worcester	600	3
	24,589,480	42,911

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PART VI

THE FORESTS AND THEIR PRODUCTS

BY

F. W. BESLEY

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THE FORESTS AND THEIR PRODUCTS

BY

F. W. BESLEY

Introductory.

From the early records it is evident that at one time nearly the entire land area of the State was covered with forests. The changes brought about by settlement and the advance of agriculture in the last 250 years, have completely altered the relation between the forest land and the cleared land. Whereas, formerly, the woodlands covered at least 90% of the land area they now occupy but 35%. This change has perhaps been more pronounced in Southern Maryland than in any other part of the State because it was in this section that the first settlements were made. The clearing of land went on with the growth of population with increased vigor, until about 1860, when the maximum was reached. Since that time more land has been abandoned and has reverted to forests than has been cleared, so the woodland area is slowly growing in extent. In Central Maryland where the advance of settlement came later, the clearing of land has been more gradual, but has continued regularly until the forests have been reduced to the minimum amount commensurate with supplying the local demand. This section has the smallest per cent. of forest lands of any in the State. The western part of the State—almost entirely of a mountainous character—has not invited agricultural development to the same extent as the other sections and there is, therefore, a relatively large per cent. of woodland. In the second place the cutting away of the forest has brought about changes in the distribution of species. This is particularly noticeable in the case of pine. In the original forest there was scarcely any pine—but now in the southern part of the State at least 30% of the woodland area is in pine stands. This has been brought about by the abandonment of cleared fields that were no longer

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productive under the existing methods of farming. Such fields, particularly those of a light sandy soil, were rapidly seeded to pine from the scattering pine stands. On the other hand in the western part of the State where white pine and pitch pine originally formed extensive forests, there has been a marked decrease in the representation of pine. Forty years ago when lumbering operations on a large scale began in this region the valuable white pine stands were the first to be cut. So complete was the cutting, and so disastrous the forest fires which followed, that white pine has been practically eliminated as a commercial timber tree. The pitch pine is a much less valuable tree, and consequently has fared somewhat better. However, practically all pure stands of this species have been cut, and now the tree is confined to scattered stands mixed with hardwoods, the latter because of greater persistence after fires, are gaining the supremacy until in time the pitch pine along with the white pine will probably exist only as isolated specimens in the forest. On the fertile soils of Central Maryland pine never has been an important tree and since lands once cleared are seldom allowed to revert to forest there is little chance of the extension of pine areas in this section.

In the third place there has been a significant change in the representation of species in the mixed hardwood stands. This is largely the result of the persistent culling of the forests that has been so universally practiced. Years ago, when lumbering began, only the best trees of the most valuable species had a market value and they were, therefore, the only ones to be cut. All defective trees and those of inferior species were left in undisturbed possession. Later on, as smaller material became valuable, the forest was again culled for the best and this has been repeated many times until in most cases there is left only defective trees and those of unmerchantable species. As a result the walnut, cherry, yellow poplar and white oak, so largely represented in the original forest, have largely given away to the less desirable species such as black oaks, beech, black gum, red gum, red maples and underbrush such as iron wood, dogwood, and the like. Forest fires have also contributed toward changes in the representation of species by killing out those that are less fire resistant and creating openings which are then oc-

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cupied by some of the light seeded species such as maple, red gum, birch, pine, etc. These changes have come about gradually over the entire state and have produced forests of quite different character from those that originally existed. Not only do the forests vary within themselves, but they are of very different character in the various sections of the state because of the marked differences in elevation and soil conditions. A detailed description of the forests will therefore appropriately follow along the lines of natural divisions.

Forest Regions of Maryland.

As regards its forests, the State may be divided into three principal divisions corresponding to the main physiographic regions—namely the Coastal Plain, the Piedmont Plateau and Blue Ridge, and the Alleghany Plateau; each presenting decided differences in elevation and soil conditions, giving rise to corresponding variations in the composition of the forests and its products.

THE COASTAL PLAIN.

The main features of the Coastal Plain section are its even topography and slight variation in soil condition resulting in few forest types. It is the only section of the state where pine is found abundantly. The Coastal Plain section can be sub-divided into two divisions, namely, Eastern Shore and Southern Maryland.

The Eastern Shore.—The Eastern Shore forests consist of two main types, pines and hardwoods. The pines, as a rule, occupy the better drained soils, and especially those of a sandy character, while the hardwood forests in the main are confined to the swampy areas, and to the heavier clay soils. The principal pine found on the eastern shore is the lobolly pine which is particularly abundant in the southern portion of the peninsula. In the northern counties of the Eastern Shore the scrub pine is found in similar locations. The pine stands are nearly always found coming in on old fields that have been abandoned, and indeed this appears to be the history of the present pine stands in all parts of Southern and Eastern Maryland. The loblolly pine forms pure stands, usually of even age, and

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occupies about thirty per cent. of the forest area of this section. The scrub pine forests are of small extent and of little commercial importance. They occur in parts of Queen Anne's, Kent and Cecil counties, but are always in small areas. The pitch pine, sometimes called foxtail pine, is found only sparingly in the central counties of the Eastern Shore, and though superior to the scrub pine as a timber tree is of little importance because of its limited distribution. The pine forests of the Eastern Shore cover about forty per cent. of the total forest area and furnish about seventy per cent. of the timber cut. The present stand of merchantable pine is 538,303,000 board feet having a stumpage value of approximately $2,320,000.

The hardwood forest may be divided into two main types, namely, the upland type growing on well drained soils, and the swamp type, occupying the swamps exclusively. The upland hardwoods are more valuable because of better soil conditions. Their general excellence is reflected in greater height growth, better development, and increased per cent. of the more valuable species. The principal commercial species are the oaks, hickory, yellow poplar, maple and red gum.

The swamp type occupies large areas in the southern counties as far north as Queen Anne's County, where it gives way to the upland type. The characteristic species are red gum, black gum, red maple, pin oak and willow oak. Since the water table is so near the surface, the root system of the swamp hardwoods is necessarily shallow, producing trees mostly of a low, scrubby growth and of relatively small per acre value as compared with the upland type.

The eastern shore hardwood forests cover about sixty per cent. of the wooded area. The present merchantable stand is 408,000,000 board feet with an approximate stumpage value of $816,000.

Forest Products.—The loblolly pine forests furnish most of the timber that is cut. The principal uses are for lumber, mine props and cordwood. Most stands are cut as soon as they reach merchantable size, that is to say, when the trees attain an average diameter of twelve to fifteen inches. As a rule, the stands are not allowed to grow large enough to make more than the poorer grades of lumber (chiefly used for box boards) and rough lumber to supply the local

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FIG. 1.—VIEW SHOWING THE TRANSITION ZONE BETWEEN SWAMP FOREST AND UPLAND WITH BRACKEN AND DWARF CORNEL.

FIG. 2.—VIEW SHOWING LARGE ROUND-LEAVED ORCHIS AND DALIBARDA IN VIRGIN FOREST, NEAR BOILING SPRING, GARRETT COUNTY.

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demand. The timber is mostly cut by portable mills, though there are a few large mills on the peninsula. During the past few years the mine timber industry has gained considerable prominence, especially where railroad shipping is feasible. Long sticks with a middle diameter of from 10″ to 18″ are most in demand, and these are shipped generally by rail in the log to the anthracite coal regions of Pennsylvania. Several thousand cords of cordwood are cut every year in this section, and shipped by water and by rail to Baltimore, Wilmington, Philadelphia and other cities.

There was formerly a large quantity of cypress along the Pocomoke River, and its tributaries, but this has been almost entirely cut out. All hardwoods are cut to a greater or less extent, but the main cut is confined to but few species, namely white oak for bridge timber and ship building, mixed oaks for piling, red gum for saw timber, and for cutting into veneer for the manufacture of berry, tomato and peach baskets. The swamp hardwoods, owing to the poor quality of material and difficulty of getting out the timber, have not been cut closely. On the other hand in the northern counties where pine is less abundant, and the hardwoods of better quality, these stands have been cut closely for timber of all kinds, especially for local uses.

The importance of the forest of the Eastern Shore section is emphasized by the following facts:

1—The mild climate and long growing season produce ideal conditions of growth.

2—The soil is especially adapted to the growing of timber, and on much of the land it will be a more profitable crop than anything else.

3—The loblolly pine, a native tree of the region, is, without doubt, the most important timber tree of the state because of its exceedingly rapid growth and the marketable value of its timber product. It forms extensive forests which, if properly managed, will insure a source of much wealth to the peninsula.

4—The natural protection against forest fires is exceptionally good, and as a result forest fires are not common. This with the

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other favorable conditions enumerated above makes investment in timber property a safe and profitable one.

5—Transportation facilities, both by water and by rail, give this section the advantage of the best markets and therefore the best timber prices.

SOUTHERN MARYLAND.—The forests of southern Maryland represent 45% of the total land area and have an approximate stumpage value of $1,498,067. The three principal forest types are mixed hardwood, mixed hardwood and pine, and pure pine. The mixed hardwood type covers the largest area and as a rule occupies the low ground in, and around swamps, also along the ravines. The principal species of this type are white oak, chestnut, black oak, maple, red gum, hickory and black gum.

The mixed hardwood and pine type occupies the higher ground bordering the mixed hardwood type, and represents the well drained areas that have never been cleared for agricultural purposes. The predominating species are scrub pine, white and black oaks, chestnut, black gum, hickory and post oak, and in the southern part of St. Mary's County a small amount of loblolly pine.

The pure pine type occurs on the upland soils that were once cleared for farming purposes and have since been abandoned. The extent of pine forests is, therefore, a good index of the amount of land once cultivated that has since reverted to forest. Scrub pine is the prevailing tree of this type occupying undisputed possession of the pine areas in the northern and central part with the exception of pitch pine in a very limited way. The latter pine comes in slightly, on sandy places around swamps in Anne Arundel County, and to a less extent in Prince George's County. In the southern half of St. Mary's County most of the pine stands consist of pure scrub pine but the loblolly pine also occupies large areas, and in some cases there are mixtures of the two species in the same stand.

The forests of Southern Maryland have been more severely cut over than those of any other section. The timber business has been prominent for many years, and even now the timber products are only exceeded by those of agriculture. The accessibility of the forests by reason of several railroads in the north and good water trans-

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portation on the south, invited early exploitation. At first the more valuable woods, like black walnut, yellow poplar, cherry and the choicest oaks were cut. Then the forest was culled again for the best of the remaining saw timber. Another visitation removed the railroad ties, telegraph and telephone poles, and now the inferior grades, that heretofore could not be cut profitably, are finding a ready market. The scrub pine and red gum, two species formerly of no value, are now eagerly sought, the first for pulp wood and the second for the cutting of veneer. Portable mills are in operation everywhere.

Forest Products.—The principal products are lumber (of which a considerable portion is used locally), and for which nearly all species are cut, but more especially, the oaks, pines and poplars; railroad ties are of oak and chestnut; pulpwood, of scrub pine, poplar and red gum; telegraph and telephone poles almost exclusively of chestnut; piles for which a variety of oaks and pine are used; and veneer made principally from red gum but also from poplar.

The forests of Southern Maryland have been one of her main sources of wealth for many years, and will always be one of the most important assets. Excessive cutting, particularly the close cutting of the valuable species, has seriously impaired the productiveness of the woodlands, so that the present forests are totally unlike the original ones, or indeed those that can be made to grow under judicious treatment. The favorable conditions are good climate and soil, cheap land (making it possible to grow timber at a good profit), valuable native species, reasonably good forest fire protection, and ease of getting out forest produce.

The restoration of the forests to their maximum of production must proceed along three main lines. (1) Improvement cuttings, which have for their object the removal of inferior species and defective trees of all classes to make room for a more valuable growth. (2) Reproduction cuttings in old stands where there is insufficient young growth. This could be accomplished by thinnings in the stand to let in light and to favor seed production and seed germination; then as seeding is accomplished the parent trees may be removed to give the young seedlings full opportunity for their best develop-

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ment. (3) Planting seed or young seedlings where open places occur in the woods, and where natural seeding may not be expected. This should be done to thicken up the stand to the point where it is fully stocked, thus leaving no idle ground. (4) Protection against forest fires, without which conservative forest management is impracticable.

THE PIEDMONT PLATEAU AND BLUE RIDGE.

The forests of this section are almost exclusively hardwood in character, but the rolling nature of the topography producing differences in soil and moisture conditions, gives great variety to the hardwood species. The soil is one well adapted for tree growth, and in consequence, the timber of this section is better developed than in any other region of the state. The good height development, and the general vigor of the trees themslves is an index of the fertility and depth of the soil so characteristic of the Piedmont Plateau. The per cent. of forest land in this section is smaller than elsewhere and is confined to relatively small areas, usually from 10 to 50 acres on farms of 200 acres or less. Land has a high agricultural value, and consequently the woodlots are usually restricted to the less arable portions of the farms. Where they do occupy good land, they are reduced to the minimum acreage required to supply home needs. The woodlands are likewise better cared for, and produce higher yields than is the case where land is cheap and the product of little value.

Forest Types.

The differences in forest types is largely determined by soil moisture, and does not lead to such sharp contrasts as was observed in swamps and uplands of the Coastal Plain area. The two principal types are the Ridge and Slope types.

The Ridge Type of forest, as the name implies, occupies the ridges and higher locations, where absence of any considerable amount of soil moisture confines the species to such trees as can endure drought conditions. The principal tree species represented are chestnut, black oak, spanish oak, chestnut oak, white oak, hickory. The Blue

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Ridge section is entirely of this type, and is the largest continuous area represented. In addition there are some of the higher ridges above stream beds, such as along Rock Creek, and the Gunpowder, also numerous rocky ridges and knolls scattered over the farm lands. The rate of growth under such unfavorable conditions is less rapid, and because of the prevalence of forest fires during the dry seasons of the year (spring and fall), the timber is generally more or less scrubby and poor. This type of the forest is drawn upon largely for fuel wood, and to some extent for railroad ties, as well as for furnishing some of the poorer grades of saw timber.

The slope type of forest is found on the lower slopes of ridges, the alluvial soil of the benches adjacent to streams, and the isolated slopes of easy gradient, everywhere. It embraces all forest land, not of the ridge type, and hence includes a relatively small area of the lowland type in Baltimore, Harford and Cecil counties adjacent to the Chesapeake Bay, where the forests approach the swamp type. Occupying, as it does, the rich, deep, soils of good drainage, it comprises the best timber of the Piedmont Section. The predominating species are white oak, poplar, red maple, black gum, red oak, pin oak and chestnut.

The chestnut, a common species of this region, will not thrive on the limestone soils and therefore it is absent from the forests of the valleys of Washington and Frederick counties and parts of Carroll County, while on the granite and sandstone soils of the other counties it is perhaps the most common species. The chestnut is a good illustration of the way soil regulates the distribution of tree species.

Very little timber is shipped out, as the local demand for building material, fencing and fuel takes almost the entire supply. A small quantity of telephone poles, railroad ties and some lumber is shipped, but this is more than offset by the amount of lumber that is brought in from elsewhere. The small per cent. of forest land will not enable the section to much more than supply the local demand, even under more careful management than that now practiced, so that timber growing will be largely of local interest, and of a character calculated to supply home needs.

From the forestry standpoint this section possesses the most promising indications of immediate progress. The main elements favor-

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ing conservative forest management are present in a greater or less degree.

1—The soil is capable of producing the best of timber.

2—The land is held high enough to encourage forest management.

3—The woodlands are in small tracts, giving the individual owners (who are always on the ground) the opportunity of constant observation and close supervision of the work of improvement.

4—There is a good local market for all forest produce.

5—The woodlots, located as they are in small tracts, and isolated by surrounding cleared land, are not subject to a considerable fire damage, and therefore the risk to forest capital is not a serious one.

THE ALLEGHANY PLATEAU.

This section has the largest per cent (60%) of woodlands of any part of the State and cuts the most timber. For many years it has been the chief seat of the lumber industry of the State, but excessive cutting and destructive fires have consumed about all of the original stand, with the result that the production is rapidly falling off. The topography is mountainous, and most of the soil is unfit for anything but a forest growth. The woodlands are mostly in large tracts along the mountain sides, and in small tracts scattered through the intervening valleys. In addition to their value in producing timber, the mountain forests greatly aid in conserving the rainfall on important watersheds, thereby preventing low water stages during period of drought, as well as preventing floods during periods of excessive rainfall.

There are three classes of forest; viz. hardwood, coniferous and a mixture of the two,—hardwood-coniferous.

The hardwood class is by far the most important as it covers about 90% of the forest area. It is characterized by a variety of tree species, the proportion of each differing somewhat in different sections because of local conditions.

The hardwood class may be separated into two well defined types, the ridge and slope types. The Ridge Type occupies the crests of the main ridges, extending in a north-easterly and south-westerly direc-

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tion. The timber of this type is generally scrubby, as might be expected on the thin soils and exposed situations, and especially is this true where forest fires are frequent, as is the case all through the mountain section. The principal species are chestnut, red oak, white oak, chestnut oak, maple and birch. This type is much more extensive than the slope type, being about in the proportion of 4 to 1, but commercially it is less important because of the poor quality of timber.

The slope type occupies the deeper soils of the lower slopes and the more favorable benches and coves where the most valuable timber is produced. The principal commercial species are chestnut, white oak, red oak, hickory, sugar maple, basswood and occasionally hemlock.

The coniferous forests consist of small areas of hemlock along lower mountain slopes adjacent to streams, and a few scattered pitch pine stands on higher situations but more particularly on southern slopes.

The mixed type of hardwood-coniferous forest is more extensive than the pure coniferous forest, but is of relatively little importance. The mixed stands of pine and hardwood usually consist of an upper story of hardwood. In a few cases white pine is found in mixture with hardwoods and nearly all hemlock stands have more or less of the hardwood mixture.

The Use of the Forests.

Before modern logging methods were as highly developed as now, and while timber was low in price, there was not sufficient inducement to push logging operations into the more inaccessible timber areas of the mountains, hence most of these areas were saved for future need. But not so with the white pine forests that occupied extensive areas, and especially where the timber was of sufficiently high value to warrant the construction of logging railroads and the equipment of large mills. This timber was cut over 35 years ago and the fires that followed lumbering operations (as they almost invariably do, in this section) practically exterminated the species. White pine in this State is now a comparatively rare timber tree,

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whereas it was once an important species in the mountain forests, and would be today except for destructive logging methods. After white pine and spruce were cut out attention was then directed to the hardwoods, and so for thirty years there has been a thorough culling of the forests for the best of the hardwood timber until few of the original stands remain. The usual method of logging is to run a light narrow gauge railroad up the river and stream valleys, and to gather in from the adjacent slopes all of the merchantable timber. In the early logging operations the term merchantable timber did not have the same significance that it has now. Then only the larger trees were taken, and much sound timber was left in the woods in tree tops and crooked logs because it would not pay for hauling. Under present market conditions, practically every sound stick big enough for a mine prop (4″ at top end and 8 feet long) is cut, leaving little but the sprouting capacity of the stumps themselves as a nucleous for a new growth. This in itself, would not be an unmitigated evil, but repeated forest fires usually prevent the natural growth from attaining anything like a fully stocked stand, thereby destroying the chance of a new forest replacing the old one.

The principal forest products are lumber, mine props, railroad and mine ties and hemlock and chestnut-oak bark. Practically all species are cut for lumber, but the principal ones are white oak, red oak, chestnut, hemlock, maple basswood and spruce. The bulk of the lumber is cut by large mills—a number of which have a daily capacity of forty thousand feet or more.

An immense quantity of mine props is cut from the smaller trees on the timber tracts to supply the nearby coal mining regions. In addition to mine props a large quantity of timber is cut into mine rails, mine ties, etc. A few years ago, while there were still large areas of hemlock timber in this section, the production of hemlock bark was an important business, and local tanneries were numerous. With the exhaustion of the hemlock stands, most of the tanneries have gone out of business, and only a small quantity of hemlock bark is produced. This all comes from the local lumbering operations where occasional stands of hemlock are lumbered.

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FIG. 1.—VIEW SHOWING FOREST FIRE, NEAR CATONSVILLE, BALTIMORE COUNTY.

FIG. 2.—VIEW SHOWING CONDITION OF A WHITE PINE STAND AFTER LUMBERING AND FOREST FIRES, NEAR THAYERVILLE, GARRETT COUNTY.

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The Future of the Forests.

There is in this section a large area of absolute forest land which will never produce anything but timber, and the problem should be how to produce the best timber crop. The rate of growth of forests on mountain land is slow, and there is, therefore, a disposition to disregard the possibilities of a second crop, after the first crop is removed. Furthermore the tax rate is high and the danger from forest fires is very great so that the inducements for conservative forest management are few. For example the present price of oak stumpage in a locality where average conditions exist is $2.50 per M. The stand of merchantable timber, per acre, is 10,000 feet B. M. giving a stumpage value of $25 per acre. The average age of the trees is 150 years. The timber crop representing 150 years of growth is therefore worth $25 per acre. Similar lands that have been cut over are worth $5 per acre. Placing the average value of the land for the past 150 years at $3 per acre, and the annual charge for taxes at 3c, the net returns on the investment including 4% compound interest and taxes would mean a loss of over $25 per acre. Under such conditions forest owners are at a decided disadvantage. There must be a readjustment of the methods of taxing forest land, and a thorough system of fire protection before much can be expected in the way of forest improvement. With the tax burden equitably adjusted to encourage the holding of forest land, and efficient fire protection the forest yields will be greatly increased, and then will timber growing become profitable and popular.

Forest Resources of Maryland.

The forest resources of the State have been made the subject of a detailed study for the past three years, and as a result of the county forest surveys, a table has been prepared showing, in a condensed form, the acreage stand and value of saw timber for each county.

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WOODED AREA, AMOUNT AND VALUE OF STANDING TIMBER.

(Includes all species of trees 10 inches and over in diameter measured at breast height, 4½ feet from the ground.)

County.	Wooded Area. Acres.	Per Cent of County wooded	Total Stand. (10″ and over in diameter.) Hardwoods. M. bd. ft.‡	Pines. M. bd. ft.‡	Total. M. bd. ft.‡	Approximate Stumpage Valve.
Allegany	163,650	51	134,948	24,164	159,112	$ 409,862
*Anne Arundel	105,348	38	89,124	5,689	94,813	239,877
*Baltimore	118,729	29	213,512	200	213,712	641,136
Calvert	62,390	45	70,638	7,717	78,355	164,427
*Caroline	72,462	33	48,308	24,154	72,462	217,381
*Carroll	32,422	11	61,464	100	61,564	184,692
*Cecil	73,931	31	62,304	420	62,724	157,020
†Charles	147,840	50	121,968	40,656	162,624	426,888
*Dorchester	149,635	41	74,683	149,364	224,047	672,139
†Frederick	50,928	12	61,020	94	61,114	183,342
Garrett	273,357	64	365,698	‡45,321	410,932	1,095,181
Harford	81,872	29	147,204	148	147,352	442,056
*Howard	57,453	36	80,300	134	80,434	240,302
Kent	33,755	17	50,129	149	50,278	174,276
*Montgomery	62,255	19	56,030	4,980	61,010	155,015
Prince George's	127,200	41	107,838	8,720	116,558	313,744
Queen Anne	59,279	25	65,558	11,019	76,577	273,529
St. Mary's	119,080	50	83,831	61,823	145,654	353,131
*Somerset	51,024	24	25,512	95,670	121,182	408,192
*Talbot	37,338	22	22,402	67,209	89,611	291,238
†Washington	73,168	20	73,000	168	73,168	146,504
Wicomico	111,513	47	26,606	97,639	124,245	416,082
Worcester	134,627	43	94,796	93,099	187,895	561,988
Totals	2,199,256	35	2,136,873	738,550	2,875,423	$8,168,002

*—Wooded area measured but stand estimated.
†—Wooded area and stand of timber estimated.
‡—Doyle log measure used.
‡—Includes hemlock.

The table shows that 35 per cent. of the land area of the State is in forest, though much of this is brush land, bearing no merchantable timber of value. The total stand of available saw timber is 2,875,423 feet board measure of which 74 per cent. is hardwood and 26 per cent. pine, including a small amount of hemlock. The principal species of hardwoods in the merchantable stands are the oaks, of which white oak is the most important, though there are eight others extensively used and together they constitute at least half of the

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stand; next in importance are the chestnut, poplar, hickory, maples, gums, ash, basswood and beech. The principal timber pine is the loblolly, often called locally the longleaf pine. The other pines are scrub or spruce pine, which, however, seldom attains saw timber size; and the pitch, or foxtail pine, which occurs but sparingly. The white pine is now little represented in the forest.

LUMBER CUT OF THE STATE.

The lumber cut of Maryland for 1907 as recently reported by the U. S. Census Bureau was 213,786,000 feet B. M., as against 219,098,000 feet B. M. for 1906. This shows a decrease of 2.4 per cent., notwithstanding the fact that 307 mills reported in 1907, while only 222 miles reported for 1906. The figures show that the maximum production has passed, and there is a decrease in the annual output due to the rapid exhaustion of our forest capital. There will be a still further reduction until, under more conservative methods of lumbering and better fire protection, our forests have had a chance to recuperate.

CUT OF LUMBER, LATH AND SHINGLES FOR 1907.

Species.	Hardwoods.		Species.	Conifers.	
	Quantity M. bd. ft.	Value.		Quantity M. bd. ft.	Value.
Oak	55,560	$1,118,455	Yellow Pine	81,541	$1,053,719
Chestnut	23,119	346,157	Hemlock	22,163	368,539
Maple	13,058	185,708	Spruce	4,882	74,847
Yellow Poplar	3,946	86,598	White Pine	1,582	28,430
Hickory	1,974	60,458	Cypress	1,175	22,825
Red Gum	1,692	22,126			
Ash	1,044	29,370	Total Conifers	111,343	1,548,360
Basswood	608	10,392	Total Hardwoods	102,443	1,881,309
Beech	534	7,238	Total lumber cut	213,786	3,429,669
Birch	326	4,641			
Cucumber	194	3,694	Laths	16,043	51,956
Elm	190	2,953	Shingles	5,467	22,087
All others	198	3,519			
			Total Value		$3,503,712
Total	102,443	$1,881,309			

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CONSUMPTION OF TAN BARK 1907.

	Quantity Cords.	Value.	Average Value Per Cord.
Oak	10,739	$102,894	$9.58
Hemlock	3,370	25,585	7.59
Total	14,109	$128,479	$9.11

MATERIAL USED FOR VENEER STOCK, BY SPECIES, 1907.

Thousand feet log measure.

Red Gum	3,183	Ash	50
Yellow Pine	915	Beech	50
Tupelo	759	Spruce	50
White Oak	750	Elm	30
Yellow Poplar	650	Birch	15
Red Oak	500	Maple	10
Walnut	200	All others	195
Chestnut	100	Total, 7,457,000 feet; value, $126,945.	

SUMMARY.

Lumber, 213,786,000 feet B. M., valued at	$3,429,669
Lath, 16,043,000 pieces, valued at	51,956
Shingles, 5,467,000 pieces, valued at	22,087
Tanbark, 14,109 cords, valued at	128,479
Veneer, 7,457,000 feet log measure, valued at	126,945
Total value	$3,759.136

Figures on the production of wood-pulp, cordwood, railroad ties, mine props, poles, piles, barrel staves, headings, etc., are not available, but it is believed that with these added the total wood production for 1907 would show a valuation at the mills of over $5,000,000.

The yearly growth on the woodlands of the State does not average more than 75 board feet per acre. Under conservative forest management it could eventually be raised to at least 400 board feet per acre and the quality of lumber correspondingly improved. The present yearly cut of lumber is 213,000,000 feet board measure, and according to the census figures for 1907, just published, there is a falling off in the timber cut from previous years, which indicates that the maximum production has been reached due to the exhaustion of nearly all of our virgin timber and that from now on, or at least

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until under more conservative forest methods better production is secured, we must be content with a greatly diminished timber supply.

This general survey of the forest resources of the State and the present consumption of timber reveals some striking facts. (1) The present yearly growth is not sufficient to supply more than one-third of the present consumption. This means that there is a heavy demand upon the forest capital, which now is so greatly depleted as to be unable to meet the demand, and consequently there is a falling off in the lumber production. (2) The cut-over forests have been left in such poor condition that their future productiveness is seriously impaired. Most of the present stand of timber is poor in quality and of low yield as compared with the production of forest judiciously managed. (3) Repeated forest fires in most of the timbered sections of the State are accountable, in a large measure, for the poor quality of forest produce and the low yields, by checking the growth, and causing defective trees. (4) The present stumpage price of timber is not high enough to thoroughly encourage conservative forest management. Prices, however, are rising rapidly, and the practice of conservative forestry is beginning to receive some consideration. When the price of lumber reaches the point that will not only cover the cost of logging and manufacture but will also include the cost of growing the timber careful forest management will be the universal practice. In other words as soon as the time comes, —and it is coming rapidly—when stumpage prices will represent the cost of replacing the trees themselves there will be sufficient inducement to care for our forests as they should be cared for.

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PART VII

LIST OF PLANTS COLLECTED AND OBSERVED

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LIST OF PLANTS COLLECTED AND OBSERVED

COMPILED BY

FORREST SHREVE

The preparation of a Flora of Maryland, or even the publication of a List of Plants Collected, was not part of the original plan of the work the results of which are embodied in the foregoing pages. However, the collections and observations of the writer, together with those of other members of the staff who collaborated in the field work, have resulted in the formation of a card list of the flora which, incomplete as it is, is sufficiently full to be worth publishing. This is particularly true in view of the fact that there has never been published a List covering the entire State. It might have been easily possible to increase the number of species listed by searching for Maryland plants in various collections, particularly those at the Maryland Agricultural College and the National Herbarium and the collection of William Canby, now at the New York College of Pharmacy. This has scarcely been deemed worth the labor it would involve, as those collections will always be quite as accessible as now, so the List as it stands embraces, with few exceptions, an entirely fresh set of observations. It is the opinion of the writer that it is more desirable at this time to increase knowledge as to the distribution, limits of range and habitat of the commoner plants of the native flora than it is to prepare complete lists of the flora elaborated by the most refined methods of present-day taxonomy.

The species embraced in this List are such as have been observed or collected by the writer either before or after the projecting of this volume, those collected by Dr. M. A. Chrysler in the Western Shore District of the Coastal Zone, and by Frederick H. Blodgett in the Upper Midland District. Additional occurrences are based on material in the collections of Robert K. Miller of Baltimore and Howard Shriver and George M. Perdew of Cumberland. A small num-

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ber of occurrences are based on the collections or creditable authority of several amateurs of Baltimore and Washington. The writer's numbers have been mostly determined at the United States National Herbarium, to the Curator and members of which grateful thanks are here returned. All of the collections made are deposited either at the National Herbarium or at the Herbarium of the Maryland Agricultural College at College Park. The collections of the writer are indicated by field numbers, those of others by the name of the person in whose herbarium the plant may be sought, or upon whose authority it is given. The writer wishes to express here his appreciation of the interest and aid of Robert K. Miller, without whose assistance the List would have lacked much of its present value.

The sequence and nomenclature follow Britton and Brown's Illustrated Flora of the Northern States and Canada (New York, 1897). The common names given are usually those of the above Flora, or else such as are in much more common use in Maryland. The statements in regard to range within the State are based on the observations of the writer and his collaborators and on such collections and literature as have been available. It is manifestly difficult to be sure that a particular plant is absent from a given area, and it is entirely within probability that many plants not now known from the Coastal Zone in Maryland will be found there. It is even more probable that many plants whose range is given as Coastal and Midland Zones will be found in the Mountain Zone when its flora is worked up, and indeed it may be taken that the writer is not reasonably sure of the absence of a plant from the Mountain Zone unless it is so stated. The habitat of each species is sometimes stated in the definite terminology of the descriptive text, or in the case of more ubiquitous plants is stated in very general terms. The profound disturbance of the natural conditions for plants in the State has made a more precise statement as to habitat impossible in the majority of cases. The frequency, which is at best a subjective matter, is expressed in only four terms,—*common, frequent, infrequent, rare,* and these always refer to the abundance of the plant in the particular habitats in which it is found.

The List includes 69 species, the occurrence of which in Maryland is beyond the limits given for them in Britton's Manual of the Flora

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of the Northern States and Canada (New York, 1901). On the other hand several species have been omitted which have been reported from the State, for example *Steuanthium robustum,* noted in Ward's List for the vicinity of Washington has not been seen by any recent collectors and may be considered as having been exterminated, if indeed not reported in error. Maryland is also reported as being the limit of range for *Yucca filamentosa* and *Agave americana.* While these species have been seen growing in the southern Eastern Shore they were in both cases too near to dwellings to be regarded as undoubtedly indigenous. In like manner the numerous Pine Barren species mentioned in Chapter II. must be omitted from the flora of Maryland although they occur both to the north and the south of the State and are tacitly credited to it in general statements of their range.

The total number of species and varieties in this List is 1400, and as stated in Chapter II. the total flora when fully collected will probably approach 1900 species.

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PTERIDOPHYTA.

OPHIOGLOSSACEAE.

Ophioglossum vulgatum L. Adder's tongue.
Coastal and Midland Zones; in moist forests; rare.
Baltimore County, Pikesville (B. W. Barton).

Botrychium matricariaefolium A. Br.
Baltimore County, Towson (C. E. Waters).

Botrychium ternatum (Thunb.) Sw. Ternate Grape-fern.
Throughout the state; in forests and open situations; most frequent in moist, sandy soil.
Garrett County, Thayerville (2051).

Botrychium dissectum Spreng.
Baltimore County, near Towson (Robert K. Miller).

Botrychium virginianum (L.) Sw. Virginia Grape-fern.
Throughout the state; in moist forests; frequent.

OSMUNDACEAE.

Osmunda regalis L. Royal Fern.
Throughout the state; in moist forests, swamps and open wet situations; common.
Talbot County, Easton (238).

Osmunda cinnamomea L. Cinnamon Fern.
Throughout the state; in moist forests, swamps and open wet situations; common.

Osmunda claytoniana L. Interrupted Fern.
Infrequent in the Midland Zone, common in the Mountain Zone; in moist forests.

SCHIZAEACEAE.

Lygodium palmatum (Bernh.) Sw. Climbing Fern.
Anne Arundel County, Millersville (P. H. Friese).

POLYPODIACEAE.

Onoclea sensibilis L. Sensitive Fern.
Throughout the state; in moist forests, swamps and open wet grounds; common.

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Onoclea struthiopteris (L.) Hoffm. Ostrich Fern.
Midland Zone; moist flood plains; rare.
Baltimore County, Warren (Robert K. Miller).

Woodsia obtusa (L.) R. Br.
Midland Zone; steep banks and shaded rocks; infrequent.
Washington County, Hancock (692); Frederick County, Sugar Loaf (1760).

Dicksonia punctilobula (Michx.) A. Gray. Hay-scented Fern.
Infrequent in the Coastal Zone, frequent in the Midland and Mountain Zones; in moist and dry forests.

Cystopteris bulbifera (L.) Bernh.
Found just outside the state at Cedar Cliff, Mineral County, West Virginia; on wet limestone rocks (1914).

Cystopteris fragilis (L.) Bernh.
Midland Zone; shaded banks and moist rocks; infrequent.
Washington County, Hancock (813).

Dryopteris acrostichoides (Michx.) Kunze. Christmas Fern.
Throughout the state; in moist and dry forests; common.

Dryopteris noveboracensis (L.) A. Gray. New York Fern.
Throughout the state; in moist forests, but commoner in open wet situations.

Dryopteris thelypteris (L.) A. Gray. Marsh Shield-fern.
Throughout the state; in moist forests and swamps; common.

Dryopteris simulata Davenp.
Anne Arundel County, Glenburnie (C. E. Waters).

Dryopteris cristata (L.) A. Gray. Crested Shield-fern.
Throughout the state; uncommon in the Eastern Shore District, infrequent in the Western Shore District in moist forests and swamps, common in the Mountain Zone in Swamps and Bogs.
Anne Arundel County, Leon (1552); Garrett County, Cranesville (2027).

Dryopteris goldieana (Hook.) A. Gray.
Baltimore County, Glyndon (C. E. Waters).

Dryopteris marginalis (L.) A. Gray.
Throughout the state; rare in the Coastal Zone, common in the Midland and Mountain Zones; in moist forests.

Dryopteris spinulosa (Retz.) Kuntze.
Midland and Mountain Zones; rare.
Garrett County, Finzel (961).

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Dryopteris spinulosa var. intermedia (Muhl.) Underw.
Throughout the state; in swamps, open wet grounds and bogs.
Anne Arundel County, Leon (1553); Garrett County, Oakland (546).

Dryopteris bootii (Tuckerm.) Underw.
Anne Arundel County, Glenburnie (C. E. Waters).

Phegopteris phegopteris (L.) Underw. Long Beech Fern.
Throughout the state; in moist forests; frequent.
Caroline County, Watts Creek (1660).

Phegopteris hexagonoptera (Michx.) Fée. Broad Beech Fern.
Midland and Mountain Zones; in moist and dry forests; infrequent.
Washington County, Hancock (830).

Phegopteris dryopteris (L.) Fée. Oak Fern.
Baltimore County, Towson (Robert K. Miller).

Woodwardia virginica (L.) J. E. Smith. Virginia Chain-fern.
Coastal Zone; in sandy swamps and thickets, and in bogs; infrequent.

Woodwardia areolata (L.) Moore.
Coastal Zone; in sandy swamps and thickets, and in bogs; frequent.

Camptosorus rhizophyllus (L.) Link. Walking Fern.
Midland Zone; on shaded rocks, more abundant on calcareous rocks but not confined to them; infrequent.
Baltimore County, Warren (453).

Asplenium pinnatifidum Nutt. Pinnatifid Spleenwort.
Washington County, Weverton, on shaded sandstone rocks (1768).

Asplenium platyneuron (L.) Oakes. Ebony Spleenwort.
Throughout the state; in dry forests; in open situations and on rocks; common.

Asplenium trichomanes L. Maiden-hair Spleenwort.
Midland and Mountain Zones; on shaded or exposed rocks; infrequent.
Allegany County, Flintstone (1018).

Asplenium angustifolium Michx. Narrow-leaved Spleenwort.
Baltimore County, moist forests along Gunpowder river near Warren (Robert K. Miller).

Asplenium ruta-muraria L.
Midland Zone; on limestone rocks; rare.
Washington County, Cavetown, Williamsport; just outside the state at Cedar Cliff, Mineral County, W. Va. (1912).

Asplenium montanum Willd. Mountain Spleenwort.
Midland and Mountain Zones; on shaded and exposed rocks, preferring sahdstone; frequent.
Washington County, Hancock (814).

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Asplenium bradleyi D. C. Eaton.
Baltimore County, Alberton; on exposed rocks (Robert K. Miller).

Asplenium acrosticholdes Sw.
Midland and Mountain Zones; moist forests; frequent.
Allegany County, Braddock Run (889).

Asplenium filix-foemina (L.) Bernh. Lady Fern.
Throughout the state; in moist forests and thickets; common.
Worcester County, Boxiron (1056); Garrett County, Swanton (558).

Adiantum pedatum L. Maiden-hair Fern.
Rare in the Coastal Zone, common in the Midland and Mountain Zones; in moist forests.
Washington County, Weverton (1775).

Pteris aquilina L. Bracken Fern.
Throughout the state; in dry forests and open situations; preferring light soils; common.

Pellaea atropurpurea (L.) Link. Cliff-brake.
Midland and Mountain Zones; on shaded and exposed rocks,—both limestone and shale,—and on steep slopes with thin soil; frequent.
Washington County, Round Top (720).

Cheilanthes lanosa (Michx.) Watt. Hairy Lip-fern.
Midland and Mountain Zones; on exposed rocks, infrequent.
Frederick County, Sugar Loaf (1761).

Polypodium vulgare L. Polypody.
Rare in the Coastal Zone, common in the Midland and Mountain Zones; most abundant on rocks and rocky slopes.
Caroline County, Watts Creek (1661).

Polypodium polypodioides (L.) A. S. Hitchk. Gray Polypody.
Montgomery County, near Great Falls on shaded rocks (1741).

MARSILIACEAE.

Marsilea quadrifolia L.
Anne Arundel County, Glenburnie; introduced at Saw Mill Pond.

EQUISETACEAE.

Equisetum arvense L. Field Horse-tail.
Throughout the state; in moist forests and moist open situations; common.

Equisetum sylvaticum L.
Baltimore County, flood plains of the Gunpowder River below Loch Raven (Robert K. Miller).

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Equisetum hyemale L. Scouring-rush.
Throughout the state; in moist forests, thickets and open situations; common.
Allegany County, Cumberland (1931).

LYCOPODIACEAE.

Lycopodium lucidulum Michx. Shining Club-moss.
Rare in the Coastal Zone; frequent in the Midland and Mountain Zones; in moist forests, preferring rocky slopes.
Baltimore County, Catonsville (1357).

Lycopodium inundatum L. Bog Club-moss.
Coastal Zone; in bogs, sandy swamps and open situations with moist sandy soil; infrequent.
Worcester County, Herring Creek (635).

Lycopodium obscurum L. Ground Pine.
Throughout the state; in dry forests; infrequent.
Talbot County, Easton (1360).

Lycopodium clavatum L. Running Pine.
Midland and Mountain Zones; on exposed rocks and in dry forests; rare.
Baltimore County, Parkton (1369); Garrett County, Thayerville (2053).

Lycopodium complanatum L. Christmas-green; Crow-foot.
Throughout the state; in dry forests; common.
Talbot County, Easton (328).

Lycopodium tristachyum Pursh.
Washington County, Tonoloway Ridge, in dry sandy woods (762).
Montgomery County, Rockville (C. E. Waters).

SELAGINELLACEAE.

Selaginella rupestris (L.) Spring. Rock Selaginella.
Midland and Mountain Zones; on open rock outcrops; infrequent.
Baltimore County, Loch Raven (451).

Selaginella apus (L.) Spring. Creeping Selaginella.
Throughout the state; on the ground among grasses in moist open situations; common.

ISOETACEAE.

Isoetes saccharata Engelm. Quillwort.
Coastal Zone; on mud between tides in estuaries and streams just above saline influence; rare.
Harford County, Gunpowder River (467).

Isoetes engelmannii var. **valida** Engelm.
Midland and Mountain Zone; in open moist situations among grasses and sedges; rare.
Frederick County, Myersville (1797); Garrett County, Crellin (1983).

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GYMNOSPERMAE.

PINACEAE.

Pinus strobus L. White Pine.

Absent from the Coastal Zone; occurs throughout the Mid'and and Mountain Zones. Reaches its best development in the Mountain Zone, is frequent in the Upper Midland District and infrequent in the Lower Midland District.

Pinus virginiana Mill. Scrub Pine, Short-leaf Pine.

Occurs throughout the Coastal and Midland Zones, is infrequent in the Mountain Zone. On the Talbot formation on the Eastern Shore it is uncommon near tide water; on the Wicomico formation it is abundant in company with Pinus taeda or in pure stands due to artificial reforestation. In the upper portion of the Eastern Shore it is a minor constituent of the deciduous forest. In the sandy portion of the Western Shore District of the Coastal Zone it is an important constituent in the coniferous forest chiefly made up of *Pinus rigida*. In other portions of the Western Shore District, and on the cretaceous gravels, it attains its greatest development in Maryland. To the north and west of the Fall Line belt of gravel soils it is sporadically common in pure stands. It is found naturally on rocky precipices or on steep slopes with thin soil, or on gravel hills. In the Mountain Zone it occurs occasionally in mixed stands to the east of Big Savage and Great Backbone mountains, but has not been seen on the plateau to the west of them.

Pinus echinata Mill. Yellow Pine.

Apparently occurs infrequently throughout the state. Reported by Mell (in MS.) for Worcester County, and by Curran for Cecil and Calvert counties. Also known from the rocky ledges of Wills Narrows, near Cumberland and from Sharptown, Wicomico County.

Allegany County, Wills Narrows (1936).

Pinus pungens Michx. f. Table Mountain Pine.

Upper Midland District and Mountain Zone. Is nowhere abundant usually occurring in company with *Pinus virginiana* or *Pinus rigida* on rocky precipices or steep mountain slopes with thin soil.

Washington County, Sideling Hill (797).

Pinus taeda L. Loblolly Pine, Fox-tail Pine, Bull Pine.

Confined to the Coastal Zone, but occurring for about 20 miles above the Fall Line along the Potomac River, and absent from Cecil and upper Kent counties (See map, Plate IV). Common in the southern Eastern Shore, particularly on the Talbot formation and on the light

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soils of the Wicomico formation south of Queen Anne's County. Is rare in central Queen Anne's County, and has not been seen in pure stand north of Cliffs Landing on Chester River in Kent County. In the Western Shore District *Pinus taeda* is common on the Talbot terrace and is frequent in the sandy section, but is infrequent on clay and gravel.

Pinus rigida Mill. Pitch Pine.

Occurs throughout the state, but is very rare in the Eastern Shore south of the Chester River, being known from the vicinity of Salisbury, and reported by Mell (in MS.) for Worcester County. On the sandy soils of the Western Shore District *Pinus rigida* is one of the principal constituents of the forest (Anne Arundel County, Glenburnie). It is rare in other parts of the Western Shore District. Throughout the Midland and Mountain Zones it is of frequent occurrence, never in pure stands but in small groups or as scattered individuals together with *Pinus virginiana* or with deciduous species, usually on sandy soil.

Larix laricina (Du Roi) Koch. Tamarack.

Mountain Zone, found only in swamp forest at Thayerville and Crauesville.

Garrett County, Thayerville (2049).

Picea mariana (Mill.) B. S. P. Black Spruce, Red Spruce.

Mountain Zone, found only in swamp and glade forest, in the former of which it is the commonest species.

Garrett County, Finzel (963).

Tsuga canadensis (L.) Carr. Hemlock.

Known from a single locality in the Coastal Zone (Caroline County, Watts Creek), and occurs throughout the Midland and Mountain Zones. In the Lower Midland District it is rare. In the Upper Midland it is frequent, particularly on rocky slopes along streams. In the Mountain Zone it is very abundant on the lower slopes of hills and Mountains, particularly in rocky soil, and also occurs in glade and swamp forests.

Taxodium distichum (L.) L. C. Rich. Bald Cypress.

Confined to the Coastal Zone. Is common in the River Swamps of the Pocomoke River and Dividing and Nassawango creeks, is infrequent on the Wicomico River. It is known in the Western Shore District of the Coastal Zone only from the vicinity of Marshall Hall, Charles County (fide Mr. William Palmer), and from Battle Creek, Calvert County.

Wicomico County, Tonytank Creek (1189).

Chamaecyparis thyoides (L.) B. S. P. White Cedar.

Confined to the southern Eastern Shore, where it occurs in swamps far above the influence of brackish water. It is infrequent on the Pocomoke River and its tributaries as far north as Steves Island and

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Willard. It is abundant in several localities on the Wicomico River, and also in the Stream Swamps of the Nanticoke River above the confluence of Marshyhope creek.
Wicomico County, Salisbury (1226).

Juniperus virginiana L. Red Cedar, Savin.
Common throughout the Coastal and Midland Zones, absent from the Mountain Zone. A tree characteristic of open situations and drier soils, now growing chiefly along roadsides and in abandoned fields, where its occurrence often forms the first stage in reforestation. The natural habitats in which it is most abundant are Serpentine Barrens and limestone cliffs.

TAXACEAE.

Taxus minor (Michx.) Britton. Yew.
Confined to the Mountain Zone, where it occurs in swamp and glade Forests and along streams in Hemlock forests.
Garrett County, Cranesville (2032).

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ANGIOSPERMAE.

MONOCOTYLEDONES.

TYPHACEAE.

Typha latifolia L. Cat-tail.

Throughout the state, in marshes and swamps, along streams, and about the margins of ponds, being most common in open situations and often forming pure stands.

Typha angustifolia L.

Throughout the Coastal Zone, and in a few localities in the Lower Midland. Is more abundant than the preceding in the lower Eastern Shore, but the two often occur together.

SPARGANIACEAE.

Sparganium eurycarpum Engel. Bur-reed.

Throughout the state; in marshes, swamps and along the margins of streams and ponds, growing in saturated soil or as an emersed aquatic; common.

Anne Arundel County, Hills Bridge (1548).

Sparganium androcladum (Engelm.) Morong.

Baltimore County, Towson (Robert K. Miller).

NAIADACEAE.

Ruppia maritima L.

Coastal Zone.

Potamogeton natans L. Pondweed.

Throughout the state; in quiet and running water; common.

Potamogeton pulcher Tuck.

Coastal and Midland Zones; in quiet and running water; frequent.

Dorchester County, Little Blackwater River (1597).

Potamogeton nuttallii Cham. Sch.

Throughout the state; in streams and ponds; common.

Worcester County, Boxiron (1065).

Potamogeton lonchites Tuck.

Coastal and Midland Zones; in streams and ponds; frequent.

Washington County, Hancock (742).

Potamogeton perfoliatus L.

Common in the Coastal Zone; infrequent in the Midland; commonest in the fresh waters at the heads of tidal estuaries.

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Potamogeton mysticus Morong.
Worcester County, Ocean City (H. L. Clark).

Potamogeton crispus L.
Coastal Zone, common in the fresh waters at the heads of tidal estuaries.

Potamogeton zosteraefolius Schum.
Harford County, Gunpowder River (Robert K. Miller).

Potamogeton pusillus L.
Coastal and Midland Zones; in ponds and streams; frequent.
Worcester County, Snow Hill (1087).

Potamogeton diversifolius Raf.
Throughout the state; in ponds and streams; common.
Dorchester County, Hurlock (1621).

Potamogeton pectinatus L.
Coastal Zone; in ponds and fresh tidal streams, frequent.
Kent County, Cliffs Landing (1697).

Naias flexilis (Willd.) Rost. & Schm.
Coastal and Midland Zones; in streams; frequent.
Washington County, Hancock (742).

Naias gracillima (A. Br.) Morong.
Wicomico County, Shad Point (1200).

Zostera marina L. Eel Grass.
Coastal Zone; in shallow salt waters of Chincoteague and Chesapeake Bays; frequent.

SCHEUCHZERIACEAE.

Triglochin striata R. & P. Arrow-grass.
Confined to the lower Eastern Shore; in salt and brackish marshes; infrequent.
Worcester County, Greenbackville (1117).

ALISMACEAE.

Alisma plantago-aquatica L. Water Plantain.
Throughout the state; in marshes and all open wet situations; common.

Lophotocarpus spongiosus (Engelm.) J. G. Smith.
Wicomico County, marshes of the Nanticoke River near Vienna (1296).

Sagittaria engelmanniana J. G. Smith.
Wicomico County near Vienna (1309).

Sagittaria latifolia Willd. (*variabilis* Engelm.) Arrow-head.
Throughout the state; in swamps and open moist situations; common.
Worcester County near Wagram (1162).

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Sagittaria latifolia var. pubescens (Muhl.) J. G. Smith.
Throughout the state; growing with the type.

Sagittaria lancifolia L. Lance-leaved Arrow-head.
Confined to the Coastal Zone; in swamps and marshes; infrequent.
Somerset County, Mattaponi Landing (1145).

Sagittaria graminea Michx.
Coastal and Midland Zones; on muddy flats, about ponds and along larger streams; infrequent.
Washington County, Hancock (736).

Sagittaria subulata (L.) Buchenau.
Coastal Zone; in mud between tides, along fresh estuaries; rare.
Wicomico County, Salisbury (1263).

VALLISNERIACEAE.

Philotria canadensis (Michx.) Britton. Water-weed, Ditch Moss.
Coastal and Midland Zones; in ponds and fresh streams; common.
Kent County, Tolchester (1698).

Vallisneria spiralis L. Eel Grass, Wild Celery.
Coastal and Midland Zones; in ponds and fresh and brackish streams; infrequent.
Cecil County, Furnace Creek (403).

GRAMINEAE.

Tripsacum dactyloides L. Gama Grass.
Coastal and Midland Zones; in fresh marshes and open moist ground; infrequent.
Worcester County, Ocean City (1253).

Erianthus compactus Nash. Plume Grass.
Coastal Zone; in marshes and moist sandy soil in open situations; infrequent.
Talbot County, Easton (605).

Andropogon scoparius Michx.
Throughout the state; in dry or rock soil.
Allegany County, Cumberland (Howard Shriver).

Andropogon argyraeus Schultes.
Wicomico County, Salisbury (Robert K. Miller).

Andropogon furcatus Muhl.
Throughout the state; in dry soil.
Garrett County, Mountain Lake Park (1955).

Andropogon virginicus L. Beard Grass.
Throughout the state; in dry fields and waste grounds; common.

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Andropogon glomeratus (Walt.) B. S. P.
Throughout the state; in moist soil and open situations; common.

Chrysopogon avenaceus (Michx.) Benth. Indian Grass.
Midland and Mountain Zones; dry soil.
Garrett County, Oakland (1916).

Paspalum setaceum Michx.
Baltimore County, Bare Hills (W. Ralph Jones).

Paspalum ciliatifolium Michx.
Baltimore County, Cockeysville (Robert K. Miller).

Paspalum laeve Michx.
Coastal and Midland Zones; moist soil, in open situations.
Worcester County, Greenbackville (1102).

Paspalum floridanum Michx.
Eastern Shore District.

Syntherisma linearis (Krock.) Nash.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Syntherisma sanguinalis (L.) Nash. Finger-grass.
Coastal Zone.

Syntherisma filiformis (L.) Nash.
Baltimore County near Cockeysville (Robert K. Miller).

Panicum crus-galli L. Cockspur Grass.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Panicum walteri Pursh.
Coastal Zone; in marshes and open moist situations; frequent.
Worcester County, near Franklin City (1127).

Panicum rostratum Muhl.
Throughout the state; in moist open situations; common.

Panicum agrostidiforme Lam.
Coastal and Midland Zones; in moist forests and meadows.
Wicomico County, near Salisbury (1260).*

Panicum longifolium Torr.
Midland Zone; in moist forests; infrequent.
Allegany County, Cumberland (Howard Shriver).

Panicum microcarpon Muhl.
Throughout the state; in dry woods and open situations.
Wicomico County, near Vienna (1322).

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*This number was determined by the United States National Herbarium, as *Panicum condensum* Nash.

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Panicum porterianum Nash.
Throughout the state; in dry forests; common.
Allegany County, Cumberland (Howard Shriver).

Panicum amarum Ell Seabeach Panicum.
Anne Arundel County.

Panicum macrocarpon Le Conte.
Caroline County, Greensborough (1643).

Panicum clandestinum L.
Coastal and Midland Zones; in open situations; common.
Allegany County, Cumberland (Howard Shriver).

Panicum oligosanthes Schultes.
Wicomico County, Tonytank Creek (1175).

Panicum nitidum Lam.
Baltimore County, Towson (Robert K. Miller).

Panicum dichotomum L.
Throughout the state; in dry woods and fields; common.

Panicum barbulatum Michx.
Throughout the state; in moist forests; common.
Worcester County, Snow Hill (1092).

Panicum viscidum Ell.
Baltimore County, Cylburn (Robert K. Miller).

Panicum pubescens Lam.
Allegany County, Cumberland (Howard Shriver).

Panicum columbianum Scribn.
Allegany County, Cumberland (Howard Shriver).

Panicum depauperatum Muhl.
Coastal and Midland Zones; in dry woods and fields; frequent.

Panicum linearifolium Scribn.
Allegany County, Cumberland (Howard Shriver); Baltimore County, near Cockeysville (Robert K. Miller).

Panicum virgatum L.
Common in the Coastal Zone, rare in the Midland Zone; most abundant along the inner edges of fresh and brackish marshes.
Somerset County, near Marion (1257).

Panicum miliaceum L.
Allegany County, Cumberland (Howard Shriver).

Panicum proliferum Lam.
Coastal and Midland Zones; in open moist situations; frequent.
Baltimore County, Cockeysville (Robert K. Miller).

Panicum capillare L.
Throughout the state; in dry soil and cultivated grounds; common.

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Panicum minus (Muhl.) Nash.
Allegany County, Cumberland (Howard Shriver).

Panicum digitarioides Carpenter. Narrow Panicum.
Wicomico County.

Panicum verrucosum Muhl.
Anne Arundel County, Glenburnie (Robert K. Miller).

Ixophorus glaucus (L.) Nash. Foxtail-grass.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Ixophorus viridis (L.) Nash.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Ixophorus italicus (L.) Nash.
Throughout the state; in cultivated grounds; frequent. Introduced from Europe.

Cenchrus tribuloides L. Bur-grass.
Coastal and Midland Zones; common in dry sandy soil.
Worcester County, Ocean City (1228).

Zizania aquatica L. Wild Rice; Water Oats.
Common in the Coastal Zone; infrequent in the Midland Zone; in fresh marshes; often forming pure stands.
Dorchester County, Drawbridge (1611).

Homalocenchrus virginicus (Willd.) Britton. White Grass.
Throughout the state; in swamps and moist forests.
Allegany County, Cumberland (Howard Shriver).

Homalocenchrus oryzoides (L.) Poll. Rice Cut-grass.
Throughout the state; in swamps, marshes and open moist situations; common.
Allegany County, Cumberland (Howard Shriver).

Phalaris arundinacea L. Reed Canary-grass.
Baltimore County, near Lake Roland (Robert K. Miller).

Phalaris caroliniana Walt.
Baltimore County, near Towson (Robert K. Miller).

Phalaris canariensis L. Canary Grass.
Allegany County, Cumberland (Howard Shriver).

Anthoxanthum odoratum L. Sweet Vernal-grass.
Throughout the state; in swamps and meadows; common.
Talbot County, Easton (1513).

Aristida dichotoma Michx. Poverty Grass.
Allegany County, Cumberland (Howard Shriver).

Stipa avenacea L.
Montgomery County, Great Falls (1456).

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Oryzopsis melanocarpa Muhl.
Allegany County, Cumberland (Howard Shriver).

Milium effusum L.
Garrett County, Oakland (561).

Muhlenbergia sobolifera (Muhl.) Trin.
Baltimore County, near Warren (Robert K. Miller).

Muhlenbergia mexicana (L.) Trin.
Coastal and Midland Zones; in moist open situations; common.
Baltimore County, Warren (Robert K. Miller).

Muhlenbergia tenuiflora (Willd.) B. S. P.
Throughout the state; in dry forests; common.
Baltimore County, Cockeysville (Robert K. Miller).

Muhlenbergia diffusa Schreb.
Throughout the state; in dry forests and open situations; common.
Allegany County, Cumberland (Howard Shriver).

Brachyelytrum erectum (Schreb.) Beauv.
Throughout the state; in moist forests; frequent.
Frederick County, Hamburg (1748).

Phleum pratense L. Timothy.
Throughout the state; in cultivated grounds; common.

Sporobolus asper (Michx.) Kunth.
Baltimore County, Loch Raven (Robert K. Miller).

Sporobolus vaginaeflorus (Torr.)
Baltimore County, Cockeysville (Robert K. Miller).

Sporobolus neglectus Nash.
Baltimore County, near Towson (Robert K. Miller).

Polypogon monspeliensis (L.) Desf. Beard Grass.
Dorchester County, Castle Haven (1590).

Cinna arundinacea L.
Coastal and Midland Zones; in swamps and open moist situations; frequent.

Agrostis alba L. Red-top.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Agrostis perennans (Walt.) Tuckerm. Thin-grass.
Midland Zone; in moist soil; frequent.

Agrostis hyemalis (Walt.) B. S. P. Rough Hair-grass.
Baltimore County, near Lutherville (Robert K. Miller).

Agrostis altissima (Walt.) Tuckerm.
Allegany County, Cumberland (Howard Shriver).

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Agrostis intermedia Scribn.
Allegany County, Cumberland (Howard Shriver).

Calamagrostis cinnoides (Muhl.) Scribn.
Coastal and Midland Zones; swamps and open moist situations; frequent.

Ammophila arenaria (L.) Link. Sea Sand-reed, Marram Grass.
Coastal Zone; confined to the Strand.
Worcester County, Ocean City (1246).

Holcus lanatus L. Velvet Grass.
Allegany County, Wills Creek (979).

Deschampsia flexuosa (L.) Trin. Hair Grass.
Throughout the state; in dry forests; common.
Washington County, Hancock (801).

Arrhenatherum elatius (L.) Beauv.
Allegany County, Cumberland (Howard Shriver); Baltimore County. Mt. Washington (Robert K. Miller).

Danthonia spicata (L.) Beauv. Wild Oat-grass.
Throughout the state; in dry woods; common.
Dorchester County, Bestpitch Ferry (1615).

Danthonia sericea Nutt.
Throughout the state; in dry situations; infrequent.
Allegany County, Cumberland (Howard Shriver).

Capriola dactylon (L.) Kuntze. Bermuda-grass.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Spartina polystachya (Michx.) Ell. Salt Reed-grass.
Common in the Coastal Zone; infrequent in the Midland Zone; characteristic of brackish and salt marshes, often occurring in pure stands.
Wicomico County, near Vienna (1298).

Spartina patens (Ait.) Muhl. Salt Meadow-grass.
Coastal Zone; in salt and brackish marshes; common.
Worcester County, Greenbackville (1126).

Spartina stricta var. **maritima** (Walt.) Scribn. Marsh Grass.
Coastal Zone; in salt and brackish marshes, often forming extensive pure stands.
Worcester County, Greenbackville (1104).

Gymnopogon ambiguus (Michx.) B. S. P.
Coastal Zone; in sandy pine forests; frequent.
Wicomico County, Salisbury (1344).

Bouteloua curtipendula (Michx.) Torr.
Baltimore County, Loch Raven (Robert K. Miller).

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Eleusine indica (L.) Gaertn. Wire-grass.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Phragmites phragmites (L.) Karst. Reed.
Coastal Zone; in fresh marshes; frequent.
Wicomico County, near Vienna (1310).

Sieglingia sesleroides (Michx.) Scribn.
Baltimore County, near Baltimore (W. Ralph Jones).

Eragrostis capillaris (L.) Nees.
Allegany County, Cumberland (Howard Shriver).

Eragrostis frankii Steud.
Allegany County, Cumberland (Howard Shriver).

Eragrostis pilosa (L.) Beauv.
Wicomico County, near Vienna (1277).

Eragrostis purshii Schrad.
Allegany County, Cumberland (928).

Eragrostis eragrostis (L.) Karst.
Baltimore County, Cockeysville (Robert K. Miller).

Eragrostis major Host.
Allegany County, Cumberland (Howard Shriver).

Eragrostis hypnoides (Lam.) B. S. P.
Allegany County, Cumberland (Howard Shriver).

Eatonia pennsylvanica (DC.) A. Gray.
Dorchester County, near Cambridge (1604).

Eatonia nitida (Spreng.) Nash.
Throughout the state; in dry forests and fields; common.
Garrett County, Swanton (491).

Melica mutica Walt.
Montgomery County, Great Falls (1450).

Uniola laxa (L.) B. S. P. Spike Grass.
Coastal Zone; in dry pine forests.
Talbot County, Easton (612).

Uniola latifolia Michx.
Midland and Mountain Zones; in moist forests; infrequent.
Washington County, Hancock (802).

Distichlis spicata (L.) Greene. Marsh Spike-grass.
Coastal Zone; in salt marshes; common.
Worcester County, Greenbackville (1121).

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Dactylis glomerata L. Orchard Grass.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Poa annua L. Meadow Grass.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Poa compressa L.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Poa pratensis L. Kentucky Blue-grass.
Throughout the state; being more frequent in the Midland and Mountain Zones.

Poa trivialis L.
Midland and Mountain Zones.
Baltimore County, Towson (Robert K. Miller).

Panicularia obtusa (Muhl.) Kuntze. Manna-grass.
Worcester County, Snow Hill (1095).

Panicularia elongata (Torr.) Kuntze.
Midland and Mountain Zones; in moist woods and open situations; infrequent.
Washington County, Smoketown (798).

Panicularia nervata (Willd.) Kuntze.
Midland and Mountain Zones; in swamps and bogs.
Garrett County, Oakland (1977).

Panicularia pallida (Torr.) Kuntze.
Dorchester County, Bucktown (1616).

Panicularia fluitans (L.) Kuntze.
Baltimore County, near Towson (Robert K. Miller).

Festuca octoflora Walt. Slender Fescue-grass.
Coastal Zone; in dry woods and open sandy situations; infrequent.
Prince George's County, Mt. Calvert (1555).

Festuca myuros L.
Coastal Zone; in dry pine forests and open sandy situations; infrequent.
Worcester County, Greenbackville (1130).

Festuca elatior L.
Throughout the state; in waste and cultivated grounds; common. Introduced from Europe.

Festuca nutans Willd.
Allegany County, Cumberland (Howard Shriver); Baltimore County, (Robert K. Miller).

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Bromus ciliatus L. Brome-grass.
Throughout the state; in dry woods and open situations.
Baltimore County, Western Run (Robert K. Miller).

Bromus hordeaceus L.
Caroline County, Greensborough (1642).

Bromus secalinus L.
Allegany County, Cumberland (Howard Shriver); Baltimore County, Timonium (Robert K. Miller).

Bromus racemosus L.
Baltimore County, near Towson (Robert K. Miller).

Bromus brizaeformis Fisch. & Mey.
Dorchester County, Castle Haven (1591).

Lolium perenne L. Rye-grass.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Lolium temulentum L. Darnel.
Throughout the state; in cultivated grounds; frequent.
Caroline County, Tuckahoe Neck (1656).

Agropyron repens (L.) Beauv. Couch Grass.
Throughout the state; in forests and fields; frequent.
Allegany County, Cumberland (1016).

Hordeum pusillum Nutt.
Charles County, Cox (1526).

Hordeum jubatum L.
Dorchester County, Castle Haven (1584).

Elymus striatus Willd. Slender Wild Rye.
Baltimore County, Western Run (Robert K. Miller).

Elymus virginicus L.
Throughout the state; in moist forests and flood-plains; frequent.
Wicomico County, Salisbury (1170).

Elymus canadensis L.
Throughout the state; in moist forests.
Baltimore County, Western Run (Robert K. Miller).

Hystrix hystrix (L.) Millsp. Bottle-brush Grass.
Midland and Mountain Zones; in dry forests; frequent.
Garrett County, Deer Park (709).

Arundinaria tecta (Walt.) Muhl. Small Cane.
Anne Arundel County, Stony Run (Robert K. Miller).

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CYPERACEAE.

Cyperus flavescens L. Yellow Cyperus.
Throughout the state; in marshes and open wet situations; common.
Wicomico County, Tonytank Creek (1178).

Cyperus diandrus Torr.
Throughout the state; in meadows and open wet situations; common.
Wicomico County, Shad Point (1205).

Cyperus rivularis Kunth.
Throughout the state; in open wet situations; frequent.
Talbot County, Easton (197).

Cyperus nuttallii Eddy.
Coastal Zone; brackish and fresh marshes; frequent.
Worcester County, Ocean City (1236).

Cyperus pseudovegetus Steud.
Coastal Zone; open moist situations; rare.
Wicomico County, Quantico (1352); Charles County, Rock Point (M. A. Chrysler).

Cyperus dentatus Torr.
Wicomico County, near Salisbury (Robert K. Miller).

Cyperus esculentus L.
Throughout the state; in open wet situations; common.
Allegany County, Cumberland (1011).

Cyperus speciosus Vahl.
Throughout the state; in meadows and open wet situations; common.

Cyperus strigosus L.
Throughout the state; in meadows and open wet situations; common.

Cyperus refractus Engelm.
Baltimore, Druid Hill Park (Robert K. Miller).

Cyperus retrofractus (L.) Torr.
Coastal Zone; dry sandy pine forests; rare.
Wicomico County, near Salisbury (1169).

Cyperus lancastriensis Porter.
Harford County, Gunpowder (Robert K. Miller).

Cyperus cylindricus (Ell.) Britton.
Throughout the state; in open wet situations; common.

Cyperus ovularis (Michx.) Torr.
Throughout the state; in moist and dry situations; common.

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Cyperus filiculmis Vahl.
Coastal and Midland Zones; open dry situations.
Washington County, Hancock (819).

Cyperus grayi Torr.
Coastal Zone; strand and dry pine forests.
Worcester County (Robert K. Miller).

Kyllinga pumila Michx.
Charles County, Allen Fresh (Robert K. Miller).

Dulichium arundinaceum (L.) Britton.
Throughout the state; in swamps, marshes, bogs and around the edges of ponds; common.
Talbot County, Easton (320).

Eleocharis acicularis (L.) R. & S.
Coastal Zone.

Eleocharis mutata (L.) R. & S. Spike-rush.
Coastal Zone; in fresh marshes; infrequent.
Dorchester County, Little Blackwater River (1605).

Eleocharis olivacea Torr.
Worcester County, Turville Creek (Robert K. Miller).

Eleocharis obtusa Schultes.
Throughout the state; in open wet situations; common.
Garrett County, Mountain Lake Park (535).

Eleocharis engelmanni Steud.
Common in the Coastal Zone, infrequent in the Midland and Mountain Zones; in open wet situations, preferring clay soil.
Dorchester County, Castle Haven (1587); Garrett County, Oakland (1944).

Eleocharis palustris var. **glaucescens** (Willd.) A. Gray
Coastal Zone; in fresh marshes; infrequent.
Dorchester County, Little Blackwater River (1606).

Eleocharis tuberculosa (Michx.) R. & S.
Throughout the state; in wet soil; common.
Worcester County, Greenbackville (1129).

Eleocharis albida Torr.
Coastal Zone; in salt and brackish marshes; rare.
Queen Anne's County, Kent Island Narrows (Robert K. Miller).

Eleocharis tricostata Torr.
Coastal Zone; in marshes and wet situations; rare.
Caroline County, Denton (1648).

Eleocharis tenuis (Willd.) Schultes.
Throughout the state; in moist woods, swamps and open wet situations.
Allegany County, Flintstone (1031).

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Eleocharis acuminata (Muhl.) Nees.
Coastal Zone; in fresh marshes; infrequent.
Dorchester County, Little Blackwater River (1608).

Eleocharis rostellata Torr.
Coastal Zone; in brackish and fresh marshes; frequent.
Kent County, Chestertown (Robert K. Miller).

Stenophyllus capillaris (L.) Britton.
Throughout the state; in dry sandy soil; common.
Caroline County, Watts Creek (1622).

Fimbristylis castanea (Michx.) Vahl.
Coastal Zone; in salt and brackish marshes; frequent.
Worcester County, Snow Hill (1037).

Fimbristylis laxa Vahl.
Common in the Coastal Zone; infrequent in the Midland Zone; in marshes and open wet situations.
Worcester County, Snow Hill (1042).

Fimbristylis autumnalis (L.) R. & S.
Throughout the state; in open moist situations.
Allegany County, Flintstone (1025).

Scirpus nanus Spreng. Club-rush.
Coastal Zone; in salt and brackish marshes; common.
Wicomico County, near Vienna (1333).

Scirpus planifolius Muhl.
Midland and Mountain Zones; in moist forests and meadows.
Baltimore County, Towson (Robert K. Miller).

Scirpus subterminalis Torr.
Coastal and Midland Zones; in swift running streams; frequent.
Dorchester County, Cabin Creek (1619).

Scirpus debilis Pursh.
Coastal and Midland Zones; in open moist situations; infrequent.
Wicomico County, Salisbury (1292).

Scirpus americanus Pers.
Throughout the state; in marshes, swamps and ponds; common.

Scirpus olneyi A. Gray.
Coastal Zone; in fresh marshes, often forming extensive pure stands.
Dorchester County, Keene Ditch (1609).

Scirpus cylindricus (Torr.) Britton.
Wicomico County, Salisbury (1218).

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Scirpus lacustris L.
Throughout the state; in fresh and brackish marshes, swamps and ponds; common.
Washington County, Hancock (778).

Scirpus robustus Pursh.
Coastal Zone; in fresh and brackish marshes; common.
Worcester County, Herring Creek (652).

Scirpus fluviatilis (Torr.) A. Gray.
Coastal Zone; in fresh marshes; rare.
Anne Arundel County, Hills Bridge (1649); Talbot County, Tuckahoe Bridge (1652).

Scirpus atrovirens Muhl.
Throughout the state; in marshes and open wet situations; common.

Scirpus polyphyllus Vahl.
Throughout the state; in open wet situations; frequent.

Scirpus cyperinus (L.) Kunth.
Throughout the state; in open wet situations; common.

Eriophorum virginicum L. Cotton-grass.
Throughout the state; in bogs and swamps; infrequent.

Fuirena squarrosa var. **hispida** (Ell.) Chapm.
Coastal Zone; in moist sandy soil.
Worcester County, Greenbackville (1115).

Rynchospora corniculata (Lam.) A. Gray. Horned Rush.
Coastal Zone; in swamps and wet sandy soil.
Worcester County, Boxiron (1099).

Rynchospora alba (L.) Vahl. Pale Beaked Rush.
Throughout the state; in bogs and wet sandy soil; frequent.
Carroll County, Westminster (1720).

Rynchospora glomerata (L.) Vahl.
Common in the Coastal Zone, infrequent in the Midland and Mountain Zones; in moist and sandy soil.
Wicomico County, near Vienna (1315).

Rynchospora gracilenta A. Gray.
Anne Arundel County, Benfield (Robert K. Miller).

Rynchospora cymosa Ell.
Coastal and Midland Zones; in open wet situations; rare.
Wicomico County, near Salisbury (Robert K. Miller).

Cladium mariscoides (Muhl.) Torr. Twig-rush.
Coastal Zone; in fresh marshes; rare.
Worcester County, near Cedar Hall (1164).

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Scleria triglomerata Michx.
Anne Arundel County, Glenburnie (Robert K. Miller).

Scleria pauciflora Muhl. Nut-rush.
Baltimore County, Soldiers Delight (Robert K. Miller).

Carex folliculata L.
Throughout the state; in swamps and moist forests; common.
Caroline County, Federalsburg (1632).

Carex intumescens Rudge.
Coastal and Midland Zones; in marshes, swamps and wet woods; common.
Wicomico County, near Vienna (1314).

Carex lupulina Muhl.
Coastal and Midland Zones; in swamps and wet forests; common.
Worcester County, Wagram (1167).

Carex lupuliformis Sartwell.
Coastal Zone; in swamps; infrequent.
Worcester County, Steves Island (Robert K. Miller).

Carex bullata Schk.
Coastal and Midland Zones; in wet forests and open situations; frequent.
Baltimore County, Bengies (Robert K. Miller).

Carex lurida Wahl.
Throughout the state; in swamps and open wet situations; common.
Wicomico County, Salisbury (1293).

Carex baileyi Britton.
Midland and Mountain Zones; in swamps and bogs; frequent.
Garrett County, Oakland (1976).

Carex hystricina Muhl.
Midland and Mountain Zones; in swamps and moist forests; infrequent.
Garrett County, Mountain Lake Park (537).

Carex comosa Boott.
Coastal and Midland Zones; in swamps and open wet situations; common.
Wicomico County, Salisbury (1290).

Carex frankii Kunth.
Baltimore County, Beaver Dam Run (Robert K. Miller).

Carex squarrosa L.
Baltimore County, Cylburn (Robert K. Miller).

Carex vestita Willd.
Coastal Zone; in moist pine forests; infrequent.
Baltimore County, Bengies (Robert K. Miller).

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Carex hirta L.
Coastal and Midland Zones; in moist forests and open situations; infrequent.
Baltimore County, near Towson (Robert K. Miller).

Carex stricta Lam.
Throughout the state; in swamps and moist forests; common.
Baltimore County, near Towson (Robert K. Miller).

Carex stricta var. **angustata** (Boott.) Bailey.
Baltimore County, Timonium (Robert K. Miller).

Carex torta Boott.
Midland Zone; in swamps; common.
Baltimore County, near Towson (Robert K. Miller).

Carex prasina Wahl.
Throughout the state; in moist forests and swamps; frequent.
Baltimore County, Soldiers Delight (1413).

Carex crinita Lam.
Throughout the state; in swamps and open wet situations.
Wicomico County, Vienna (1311).

Carex virescens Muhl.
Coastal and Midland Zones; in dry forests.
Caroline County, near Greensborough (1644).

Carex costellata Britton.
Coastal and Midland Zones; in moist forests; frequent.
Talbot County, near Easton (1509).

Carex triceps Michx.
Baltimore County, near Timonium (Robert K. Miller).

Carex caroliniana Schwein.
Coastal and Midland Zones; in swamps and moist forests; common.
Dorchester County, Bucktown (1610).

Carex tenuis Rudge.
Baltimore County, near Timonium (Robert K. Miller).

Carex grisea Wahl.
Montgomery County, Great Falls (1444).

Carex amphibola Steud.
Talbot County, near Easton (1510); Baltimore County, Cylburn (Robert K. Miller).

Carex granularis Muhl.
Baltimore County, Cockeysville (Robert K. Miller).

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Carex laxiflora Lam.
Midland Zone; in moist forests; common.
Montgomery County, Great Falls (1447).

Carex laxiflora var. blanda (Dewey) Boott.
Montgomery County, Great Falls (1427).

Carex laxiflora var. varians Bailey.
Montgomery County, Great Falls (1452).

Carex laxiflora var. divaricata Bailey.
Montgomery County, Great Falls (1467).

Carex styloflexa Buckley.
Montgomery County, Great Falls (1441).

Carex albursina Sheldon.
Baltimore County, Warren (Robert K Miller).

Carex laxiculmis Schwein.
Coastal Zone; in sandy swamps and flood plains; frequent.
Caroline County, Federalsburg (1630).

Carex platyphylla Carey.
Midland and Mountain Zones; in moist and dry forests; frequent.
Baltimore County, Western Run (1396).

Carex pedicellata (Dewey) Britton.
Baltimore County, Western Run (1389).

Carex pennsylvanica Lam.
Throughout the state; in moist and dry forests; common.
Baltimore County, Parkton (1367).

Carex varia Muhl.
Midland Zone; in dry forests; frequent.
Baltimore County, Parkton (1366).

Carex varia var. colorata Bailey.
Baltimore County, Western Run (1390).

Carex nigro-marginata Schwein.
Baltimore County, Parkton (1365).

Carex leptalea Wahl.
Baltimore County, near Cockeysville (Robert K. Miller).

Carex conjuncta Boott.
Baltimore County, near Towson (Robert K. Miller).

Carex stipata Muhl.
Montgomery County, Great Falls (1437).

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Carex vulpinoidea Michx.
Throughout the state; in swamps and moist forests; common.
Talbot County, near Easton (1507).

Carex xanthocarpa Bicknell.
Throughout the state; in swamps and open wet situations; common.
Washington County, near Hancock (785).

Carex rosea Schk.
Midland and Mountain Zones; in moist forests; infrequent.
Allegany County, near Cumberland (1925).

Carex rosea var. **radiata** Dewey.
Throughout the state; in swamps and open wet situations; common.
Talbot County, near Easton (1512).

Carex retroflexa Muhl.
Montgomery County, Great Falls (1468).

Carex cephalophora Muhl.
Montgomery County, Great Falls (1440).

Carex muhlenbergii Schk.
Baltimore County, near Towson (Robert K. Miller).

Carex atlantica Bailey.
Midland and Mountain Zones; in bogs and swamps; infrequent.
Garrett County, near Oakland (511).

Carex tribuloides Wahl.
Throughout the state; in open wet situations; common.
Washington County, near Hancock (786).

Carex scoparia Schk.
Baltimore County, near Timonium (Robert K. Miller).

Carex cristatella Britton.
Baltimore County, near Cockeysville (Robert K. Miller).

Carex silicea Olney.
Worcester County, Ocean City, on sand dunes (Robert K. Miller).

Carex tenera Dewey.
Montgomery County, Great Falls (1464).

Carex albolutescens Schwein.
Coastal Zone; in fresh and brackish marshes; frequent.
Wicomico County, near Vienna (1323).

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ARACEAE.

Arisaema triphyllum (L.) Torr. Jack-in-the-pulpit.
Throughout the state; in moist forests; common.

Arisaema dracontium (L.) Schott. Green Dragon.
Midland and Mountain Zones; in moist forests and flood plains; rare.
Harford County, near Glenville (1571).

Peltandra virginica (L.) Kunth.
Coastal Zone; in fresh marshes and about the edges of ponds; common.

Spathyema foetida (L.) Raf. Skunk Cabbage.
Throughout the state; in moist forests and open wet situations; common.

Orontium aquaticum L. Golden Club.
Common in the Coastal Zone, rare in the Midland and Mountain Zones; most abundant in fresh marshes along the upper waters of tidal streams; infrequent in swamps.
Anne Arundel County, Hills Bridge (1544); Garrett County, near Finzel, altitude 2700 ft. (George M. Perdew).

Acorus calamus L. Sweet Flag.
Common in the Coastal Zone, infrequent in the Midland Zone; in fresh marshes and about the edges of ponds.
Anne Arundel County, Hills Bridge (1546).

LEMNACEAE.

Spirodela polyrhiza (L.) Schleid. Duckweed.
Throughout the state; in ponds and quiet waters; common.

Lemna minor L. Duckweed.
Throughout the state; in ponds and slow streams; common.

XYRIDACEAE.

Xyris flexuosa Muhl.
Coastal and Midland Zones; in moist forests and open situations; infrequent.
Baltimore County, Towson (Robert K. Miller).

Xyris communis Kunth.
Throughout the state, being common in the Coastal Zone, infrequent in the Midland and Mountain Zones; in moist sandy forests and open situations.
Worcester County, Snow Hill (1047).

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Xyris caroliniana Walt.

Coastal and Midland Zones; in marshes, swamps and open wet situations; frequent.

Worcester County, Snow Hill (1043); Wicomico County, Shad Point (1201).*

ERIOCAULACEAE.

Eriocaulon septangulare With. Pipewort.

Common in the Coastal Zone, infrequent in the Midland, being most abundant in the shallow water and fresh estuaries about the head of the Chesapeake Bay.

Cecil County, Furnace Creek (402).

Eriocaulon decangulare L.

Confined to the Coastal Zone; in fresh marshes and bogs; infrequent.

Wicomico County, near Vienna (1300).

COMMELINACEAE.

Commelina nudiflora L. Day-flower.

Throughout the state; in moist cultivated grounds; common.

Commelina hirtella Vahl.

Confined to the Coastal Zone; in swamps and moist forests; rare.

Worcester County, Steves Island (669).

Tradescantia virginiana L. Spiderwort.

Throughout the state; in moist waste grounds; common.

PONTEDERIACEAE.

Pontederia cordata L. Pickerel-weed.

Throughout the state; in marshes and swamps and about the edges of ponds; common in the Coastal Zone, less frequent in the Midland and Mountain Zones.

Heteranthera reniformis R. & P.

Costal and Midland Zones; in shallow water, about the edges of ponds and in the estuaries at the head of the Chesapeake Bay.

Cecil County, Furnace Creek (399).

Heteranthera dubia (Jacq.) MacM. Water Star-grass.

Washington County, near Hancock (790).

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*This number was determined by the United States National Herbarium as *Xyris fimbriata* Ell.

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JUNCACEAE.

Juncus effusus L. Bulrush.
Throughout the state; in wet open situations, ditches and ponds; common.

Juncus roemerianus Scheele.
Coastal Zone; in brackish marshes; infrequent.
St. Mary's County, St. Georges Island (M. A. Chrysler).

Juncus bufonius L.
Throughout the state; in moist open situations; infrequent.
Dorchester County, Castle Haven (1592).

Juncus gerardi Lois.
Coastal Zone; in salt and brackish marshes; common.
Somerset County, Marion (1255).

Juncus tenuis Willd.
Throughout the state; in moist and dry waste situations; common.

Juncus secundus Beauv.
Midland Zone; in dry open situations; infrequent.
Frederick County, Catoctin Mountain (1745).

Juncus dichotomus Ell.
Coastal Zone; in moist sandy soil, in open situations; infrequent.
Dorchester County, Castle Haven (1593).*

Juncus marginatus Rostk.
Throughout the state; in moist open situations; common.
Baltimore County, near Towson (Robert K. Miller).

Juncus repens Michx.
Coastal Zone; in wet sandy soil; infrequent.
Wicomico County, near Quantico (1351).

Juncus pelocarpus E. Meyer.
Anne Arundel County, Glenburnie (2063).

Juncus scirpoides Lam.
Throughout the state; in open dry situations; common.

Juncus canadensis J. Gray.
Throughout the state; in open moist situations; common.

Juncus acuminatus Michx.
Throughout the state; in open wet grounds; common.

Juncoides campestre (L.) Kuntze.
Throughout the state; in moist forests; common.
Garrett County, Oakland (518).

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*This number was determined as *Juncus dudleyi* Weigand, by the United States National Herbarium.

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MELANTHACEAE.

Chamaelirium luteum (L.) A. Gray. Blazing-star.
Throughout the state; in dry forests; frequent.
Garrett County, Mountain Lake Park (536).

Chrosperma muscaetoxicum (Walt.) Kuntze. Fly-poison.
Coastal and Midland Zones; in dry forests; rare.
Anne Arundel County, Glenburnie (Robert K. Miller).

Melanthium virginicum L. Bunch-flower.
Wicomico County, Salisbury (1288).

Melanthium latifolium Desr. Crisped Bunch-flower.
Baltimore County, near Timonium (Robert K. Miller).

Veratrum viride Ait. American White Hellebore.
Throughout the state; in moist forests and swamps; common.

Uvularia perfoliata L. Bellwort.
Throughout the state; in moist forests; frequent.

Uvularia grandiflora J. E. Smith.
Mountain Zone; in moist forests; infrequent. (Joseph E. Harned.)

Uvularia sessilifolia L.
Throughout the state; in moist forests; common.

Tofieldia glutinosa (Mx.) Pers.
Midland Zone.

LILIACEAE.

Hemerocallis fulva L. Day Lily.
Throughout the state; in roadsides and waste places; frequent.

Allium cernuum Roth.
Upper Midland District and Mountain Zone; on moist cliffs and banks; infrequent.
Washington County, Hancock (810).

Allium vineale L. Garlic.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Lilium canadense L.
Throughout the state; in open moist situations; infrequent.

Lilium superbum L.
Throughout the state; in moist open situations; frequent.

Erythronium americanum Ker. Adder's-tongue.
Rare in the Coastal Zone, common in the Midland and Mountain Zones in moist forests.

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Erythronium albidum Nutt.
Montgomery County, near Great Falls (Frederick H. Blodgett).

Ornithogalum umbellatum L. Star-of-Bethlehem.
Throughout the state; in cultivated grounds; common.

Ornithogalum nutans L.
Howard County, Patapsco River (Robert K. Miller).

Muscari botryoides (L.) Mill.
Montgomery County, Great Falls (Robert K. Miller).

Muscari racemosum (L.) Mill.
Throughout the state; in cultivated grounds; frequent. Introduced from Europe.

Aletris farinosa L.
Throughout the state; in dry and moist sandy soil; infrequent.
Queen Anne's County, near Sudlerville (1683).

CONVALLARIACEAE.

Asparagus officinalis L. Asparagus.
Coastal Zone; in waste situations near tide water; frequent.

Clintonia borealis (Ait.) Raf.
Mountain Zone; in moist forests and swamps; rare.
Garrett County, Oakland (Joseph E. Harned).

Clintonia umbellulata (Michx.) Torr.
Mountain Zone; in moist forests and swamps; frequent.
Garrett County, Swanton (2004).

Vagnera racemosa (L.) Morong. Wild Spikenard.
Throughout the state; in moist forests; common.

Vagnera stellata (L.) Morong.
Montgomery County, Great Falls (459).

Unifolium canadense (Desf.) Greene.
Midland and Mountain Zones; in moist forests; common.

Disporum lanuginosum (Michx.) Nichols.
Mountain Zone; in moist forests; frequent.
Garrett County, Boiling Spring (1957).

Streptopus amplexifolius (L.) DC.
Garrett County, Oakland (Joseph E. Harned).

Streptopus roseus Michx.
Mountain Zone; in moist forests; rare.
Garrett County, Boiling Spring (1958).

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Polygonatum biflorum (Walt.) Ell. Solomon's Seal.
Throughout the state; in moist forests; common.

Polygonatum commutatum (R. & S.) Dietr.
Midland and Mountain Zones; in moist forests; infrequent.
Washington County, Williamsport (1808).

Medeola virginiana L. Indian Cucumber-root.
Throughout the state; in moist forests and swamps; common.

Trillium nivale Riddell. Early Wake-robin.
Garrett County, Oakland (Joseph E. Harned).

Trillium erectum L.
Midland and Mountain Zones; in moist rocky places; frequent.
Washington County, Hancock (811).

Trillium cernuum L.
Midland and Mountain Zones; in moist forests; infrequent.

Trillium undulatum Willd.
Upper Midland District and Mountain Zone; moist forests.
Garrett County, Big Savage Mountain (833).

SMILACEAE.

Smilax herbacea L. Greenbrier.
Throughout the state; in dry forests; infrequent.

Smilax tamnifolia Michx.
Anne Arundel County, Severn River (Robert K. Miller).

Smilax glauca Walt.
Throughout the state; in dry forests; common.
Wicomico County, near Salisbury (1269).

Smilax rotundifolia L. Catbrier.
Throughout the state; in dry and moist forests and swamps; common.

Smilax laurifolia L.
Coastal Zone; in upland swamps and river swamps; infrequent.
Wicomico County, near Salisbury (1283).

Smilax walteri Pursh.
Anne Arundel County, Patapsco River (Charles C. Plitt).

Smilax hispida Muhl.
Mountain Zone.

AMARYLLIDACEAE.

Hypoxis hirsuta (L.) Coville. Star-grass.
Throughout the state; in dry forests and open situations; common.
Harford County, Fallston (1576).

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DIOSCOREACEAE.

Dioscorea villosa L. Wild Yam-root.
Throughout the state; in moist and dry forests; common.

IRIDACEAE.

Iris versicolor L.
Throughout the state; being most common in fresh marshes and swamps in the Coastal Zone.
Charles County, Allen Fresh (1536).

Iris verna L.
Coastal Zone; in moist forests, on sandy soil; infrequent.
Anne Arundel County, Glenburnie (Robert K. Miller).

Sisyrinchium graminoides Bicknell.
Coastal and Midland Zone; in moist forests and open situations; common.
Talbot County, Easton (1495).

ORCHIDACEAE.

Cypripedium acaule Ait. Moccasin Flower.
Coastal and Midland Zone; in dry forests; preferring sandy soil; common in the Coastal Zone, less frequent in the Midland Zone.

Cypripedium hirsutum Mill. (*pubescens* Willd.) Large Yellow Ladies' Slipper.
Mountain Zone; in moist forests; frequent.
Garrett County, Oakland (Joseph E. Harned).

Cypripedium parviflorum Salisb. Small Yellow Ladies' Slipper.
Midland and Mountain Zones; moist forests, being rare in the Midland Zone, frequent in the Mountain Zone.
Garrett County, Oakland (Joseph E. Harned).

Orchis spectabilis L. Showy Orchis.
Throughout the state; in moist forests; infrequent.

Habenaria orbiculata (Pursh.) Torr. Large Round-leaved Orchis.
Upper Midland District and Mountain Zone; in moist forests; rare.
Garrett County, Boiling Spring (1970).

Habenaria bracteata (Willd.) R. Br. Long-bracted Orchis.
Garrett County, Boiling Spring (1969).

Habenaria clavellata (Michx.) Spreng. Small Green Wood Orchis.
Throughout the state; in moist forests, swamps and bogs; common.

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Habenaria cristata (Michx.) R. Br. Crested Yellow Orchis.
Coastal Zone; in upland swamps and open situations with moist sandy soil.
Worcester County, Boxiron (1055).

Habenaria ciliaris (L.) R. Br. Yellow Fringed Orchis.
Coastal and Midland Zones; in moist forests, preferring sandy soil; infrequent.
Washington County, near Smoketown (1793).

Habenaria blepharigiottis (Willd.) Torr. White Fringed Orchis.
Coastal Zone; in moist sandy forests; infrequent.
Baltimore County, Bengies (Robert K. Miller).

Habenaria lacera (Michx.) R. Br. Ragged Orchis.
Queen Anne's County, Sudlerville (1669).

Habenaria grandiflora (Bigel.) Torr.
Garrett County, Kelso Gap (555).

Habenaria psycodes (L.) A. Gray.
Garrett County, Oakland (Joseph E. Harned).

Habenaria peramoena A. Gray. Fringeless Purple Orchis.
Allegany County, Cumberland (Howard Shriver).

Pogonia ophioglossoides (L.) Ker. Rose Pogonia.
Queen Anne's County, near Sudlerville (1674).

Pogonia verticillata (Willd.) Nutt. Whorled Pogonia.
Throughout the state; in dry forests, preferring sandy soil.
Washington County, near Smoketown (1796).

Gyrostachys cernua (L.) Kuntze. Nodding Ladies' Tresses.
Throughout the state; in moist forests and open situations; frequent.
Cecil County, Calvert (418).

Gyrostachys praecox (Walt.) Kuntze. Grass-leaved Ladies' Tresses.
Throughout the state; in open moist situations; frequent.

Gyrostachys simplex (A. Gray) Kuntze. Little Ladies' Tresses.
Coastal Zone; in moist forests, preferring sandy soil.
Worcester County, Boxiron (1068).

Gyrostachys gracilis (Bigel.) Kuntze. Slender Ladies' Tresses.
Coastal and Midland Zones; in moist open situations; common.

Peramium pubescens (Willd.) MacM. Rattlesnake Plantain.
Throughout the state; in dry forests; frequent.
Garrett County, Kelso Gap (2043).

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Achroanthes unifolia (Michx.) Raf. Green Adder's-mouth.
Mountain Zone; in dry forests; rare.
Garrett County, near Crellin (1979).

Leptorchis liliifolia (L.) Kuntze. Large Twayblade.
Baltimore County, near Towson (Robert K. Miller).

Corallorhiza wisteriana Conrad. Wister's Coral-root.
Midland and Mountain Zones; in dry forests; infrequent.
Garrett County, Crellin (1980).

Corallorhiza multiflora Nutt. Large Coral-root.
Throughout the state; in moist and dry forests; infrequent.
Baltimore County, near Towson (Robert K. Miller).

Corallorhiza corallorhiza (L.) Karsts. Early Coral-root.
Midland Zone.

Tipularia unifolia (Muhl.) B. S. P. Crane-fly Orchis.
Coastal Zone; in moist and dry forests; infrequent.
St. Mary's County, Piney Point (M. A. Chrysler).

Limodorum tuberosum L. Grass-pink.
Queen Anne's County, near Sudlerville (1673).

Aplectrum spicatum (Walt.) B. S. P. Adam-and-Eve.
Baltimore County, near Cockeysville (Robert K. Miller).

DICOTYLEDONES.

SAURURACEAE.

Saururus cernuus L. Lizard's Tail.
Coastal and Midland Zones; in swamps and marshes and about the margins of ponds; being common in the Coastal Zone and infrequent in the Midland Zone.

JUGLANDACEAE.

Juglans nigra L. Black Walnut.
Throughout the state in upland forests, preferring deep loam soil; rare in the Coastal Zone, apparently being absent out of cultivation in the lower Eastern Shore; frequent in the Midland and Mountain Zones.

Juglans cinerea L. Butternut.
Throughout the state in upland forests, preferring the rich humus soils of the lower slopes of mountain ridges; apparently absent from the Eastern Shore, rare in the Western Shore District of the Coastal Zone, infrequent in the Lower Midland District, frequent in the Upper Midland District and the Mountain Zone.

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Hicoria minima (Marsh.) Britton. Bitternut Hickory.
Throughout the state; in moist forests and flood plains, being most abundant in the flood plains of the Midland Zone.
Frederick County, near Sugar Loaf (1762).

Hicoria ovata (Mill.) Britton. Shagbark Hickory.
Midland and Mountain Zones; in dry Upland forests; rare in the Lower Midland District, frequent in the Upper Midland and the Mountain Zone.

Hicoria alba (L.) Britton. Mockernut Hickory.
Throughout the state; in dry Upland forests; most abundant in the northern counties of the Eastern Shore and in the Midland Zone.

Hicoria microcarpa (Nutt.) Britton.
Midland and Mountain Zones; in moist Upland forests, preferring mountain slopes; rare.

Hicoria glabra (Mill.) Britton. Pignut Hickory.
Throughout the state; in Upland forests; common.

MYRICACEAE.

Myrica cerifera L. Wax Myrtle.
Coastal Zone, being confined to the southern counties of the Eastern Shore; is most abundant in river swamps and sandy-loam upland swamps, also occurring in upland forests.
Caroline County, Dover Bridge (2067).

Myrica carolinensis Mill. Bayberry.
Coastal Zone, apparently being absent from the remainder of the state; frequent on dunes and in other open situations with dry sandy soil, also in clay upland forests.
Worcester County, Berlin (645).

Comptonia peregrina (L.) Coulter. Sweet Fern.
Throughout the state, being most abundant in the Midland and Mountain Zones; in dry upland forests and open situations, flourishing in cleared and burnt-over forests.

SALICACEAE.

Populus alba L. Silver Poplar.
Throughout the state in cultivated grounds; introduced from Europe.

Populus heterophylla L. Swamp Poplar.
Coastal Zone; in river swamps and upland swamps, frequent in occurrence but never numerous in individuals.
Worcester County, Snow Hill (1090).

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Populus grandidentata Michx. Large-toothed Poplar.
Rare in the Eastern Shore District, infrequent throughout the remainder of the state.

Populus tremuloides Michx. American Poplar.
Mountain Zone; infrequent about the margins of forests and swamps.

Populus dilatata Ait. Lombardy Poplar.
Throughout the state in cultivated grounds. Introduced from Europe.

Salix nigra Marsh. Black Willow.
Throughout the state; in flood plains and along streams; common.
Dorchester County, Little Blackwater River (1602).

Salix wardii Bebb.
Midland Zone; frequent at several localities along the Potomac River.
Allegany County, Cumberland (1014).

Salix alba var. vitellina (L.) Koch. White Willow.
Throughout the state; in flood plains and along streams; common.

Salix babylonica L. Weeping Willow.
Throughout the state; in cultivated grounds. Introduced from Europe.

Salix humilis Marsh. Prairie Willow.
Coastal and Midland Zones; in dry forests and open situations; frequent.

Salix tristis Ait. Sage Willow.
Throughout the state; in dry open situations and on thin rocky soil; frequent.
Cecil County, near Elkton (376).

Salix discolor Muhl. Pussy Willow.
Coastal and Midland Zones; along streams; infrequent.

Salix sericea Marsh. Silky Willow.
Midland and Mountain Zones; along streams; frequent.
Allegany County, Braddock Run (905).

BETULACEAE.

Carpinus caroliniana Walt. Hornbeam, Blue Beech.
Throughout the state, being most common in flood plains and along streams in the Midland Zone; also frequent in moist forests and infrequent in swamps throughout the Midland and Mountain Zones; infrequent in the southern, and frequent in the northern Eastern Shore.

Ostrya virginiana (Mill.) Willd. Hop-hornbeam, Ironwood.
Midland and Mountain Zones; in moist forests and on rocky slopes; infrequent.

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Corylus americana Walt. Hazel-nut.

Throughout the state; being rare in the Coastal Zone, and frequent in the Midland Zone in dry forests and open situations.

Corylus rostrata Ait. Beaked Hazel-nut.

Upper Midland District and Mountain Zone; in moist and dry forests on mountain slopes; infrequent.

Frederick County, Thurmont (1753).

Betula nigra L. River Birch.

Throughout the state; frequent in the Coastal Zone in flood plains and stream swamps, common in the Midland Zone in flood plains and along streams. Also infrequent in dry situations.

Betula lenta L. Sweet Birch.

Apparently absent from the Eastern Shore, rare in the Western Shore District of the Coastal Zone, frequent in the Upper Midland District and Mountain Zone; preferring mountain slopes, in deep or rocky soil.

Betula lutea Michx. Yellow Birch.

Mountain Zone; in swamp and glade forests and along streams; frequent.

Alnus incana (L.) Willd. Hoary Alder.

Mountain Zone; in swamps and bogs; infrequent.

Garrett County, near Oakland (1996).

Alnus rugosa (Du Roi) K. Koch. Alder.

Throughout the state; in swamps and flood plains and along streams in open wet situations; common.

Alnus maritima (Marsh.) Muhl.

Coastal Zone; confined to the stream swamps of the Wicomico and Nanticoke rivers, where it is invariably associated with *Chamaecyparis;* rare.

Wicomico County, Tonytank Creek (1191).

FAGACEAE.

Fagus americana Sweet. Beech.

Throughout the state; in the Coastal Zone it is infrequent in moist upland forests and swamps, and most common on the slopes leading from streams and swamps to the upland; in the Midland Zone it is frequent in moist forests and flood plains; in the Mountain Zone it is infrequent in the forests of mountain slopes.

Castanea dentata (Marsh.) Borkh. Chestnut.

Rare on the Eastern Shore south of Queen Anne's County, being confined to the gravel slopes, common in Cecil County and the Western Shore District of the Coastal Zone, preferring gravel soil; common in

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the Lower Midland District, where it is one of the characteristic Upland forest trees, less common in the Upper Midland District and Mountain Zone, where it prefers mountain ridges and thin rocky soil.

Castanea pumila (L.) Mill. Chinquapin.

Locally common throughout the state, as in northern Dorchester County, near East New Market, in Anne Arundel County near Glenburnie, in Charles County, near Bel Alton, and on the summits of Catoctin and Blue Ridge; prefers open situations in sand or thin rocky soil.

Quercus rubra L. Red Oak.

Rare in the Coastal Zone, frequent in the Lower Midland District but most abundant in the Upper Midland District and the Mountain Zone, where it prefers the lower slopes of mountain ridges or occurs less abundantly in dry forests.

Quercus palustris Du Roi. Swamp Oak.

Throughout the state, absent from the river and stream swamps of the Eastern Shore, common in the upland swamps and flood plains; common in flood plains and along streams throughout the Midland and Mountain Zones.

Quercus coccinea Wang. Scarlet Oak.

Throughout the state, being frequent in the Coastal Zone, and common in the Midland and Mountain Zones, where it is one of the characteristic forest trees; most abundant in the dry forests of slopes and ridges.

Quercus velutina Lam. Black Oak.

Throughout the state; being one of the three commonest oaks in the Coastal Zone and one of the two commonest in the remainder of the state; an important constituent of all upland forests and frequent in flood plains.

Quercus digitata (Marsh.) Sudw. Spanish Oak.

Throughout the Coastal Zone, extending beyond the "Fall-line" up the Potomac River as far as Seneca Creek, and infrequently elsewhere; is one of the two commonest oaks in the southern Eastern Shore, where it prefers dry upland soils.

Quercus nana (Marsh.) Sarg. Scrub Oak, Bear Oak.

Apparently absent from the Eastern Shore District of the Coastal Zone, infrequent in the Western Shore District, being common in the Upper Midland District and the Mountain Zone, where it prefers open situations with thin rocky soil, as the summits of the Catoctin mountains and the cut-over forests of Garrett County.

Quercus marylandica Muench. Black Jack Oak.

Throughout the Coastal and Midland Zones, apparently being absent from the Mountain Zone. Its relative abundance is greatest on the

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Serpentine Barrens of the Lower Midland District; it is locally common in sandy soil and on thin rocky slopes throughout the Coastal and Midland Zones, being least frequent in the Upper Midland District.

Quercus nigra L. Water Oak.

Confined to the Southern Eastern Shore where it has not been observed north of Greensborough, Caroline County; it is most abundant in sandy-loam upland swamps and in flood plains with sandy soil, is infrequent in clay upland and in well-drained sandy soils.

Worcester County, near Berlin (656).

Quercus phellos L. Willow Oak.

Throughout the Coastal Zone and beyond the "Fall-line" along the Potomac River as far as Seneca Creek; is infrequent in river swamps and stream swamps, common in upland swamps and flood plains and in clay upland, frequent in sandy-loam upland.

Quercus imbricaria Michx. Shingle Oak.

Confined to the vicinity of Barnesville, Gaithersburg and Great Falls in Montgomery County, and Zekiah Swamp in Charles County.

Quercus alba L. White Oak.

Throughout the state, being the commonest of the oaks and one of the commonest forest trees; it grows in swamps and on the upland in soils of every character in every county of the state, attaining its best development in the deep well-drained upland soils.

Quercus minor (Marsh.) Sarg. Post Oak, Iron Oak.

Coastal and Midland Zones, apparently absent from the Mountain Zone; frequent in the Coastal Zone on light, well-drained soil, is relatively most abundant on the Serpentine Barrens, is frequent elsewhere in Lower Midland District, infrequent in the Upper Midland.

Quercus lyrata Walt. Overcup Oak.

Charles County, Zekiah Swamp (M. A. Chrysler).

Quercus macrocarpa Michx. Bur Oak.

Throughout the state; in flood plains and moist forests; the rarest of the oaks.

Queen Anne's County, Starr (1666).

Quercus platanoides (Lam.) Sudw. Swamp White Oak.

Coastal and Midland Zones, not noted in the Mountain Zone; in flood plains and along streams; rare.

Howard County, near Mt. Airy (1723).

Quercus michauxii Nutt. Cow Oak.

Coastal Zone; in flood plains and upland swamps, being most abundant in the upland clay swamps of the Eastern Shore.

Anne Arundel County, Galesville (M. A. Chrysler).

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Quercus prinus L. Chestnut Oak.
Absent from the southern counties of the Eastern Shore; rare in Caroline and Talbot counties, frequent in Upper Queen Anne's, Kent and Cecil, preferring gravel soil; common throughout the Midland and Mountain Zones, preferring gravel soil and rocky slopes and ridges.

Quercus acuminata (Michx.) Sarg. Yellow Oak.
Upper Midland District; in upland soils; rare.
Montgomery County, Barnesville (Frederick H. Blodgett).

Quercus prinoides Willd. Scrub Chestnut Oak.
Western Shore District of the Coastal Zone, Lower Midland District in sand or the thin soil of rocky slopes; infrequent.
Anne Arundel County, Glenburnie (M. A. Chrysler).

ULMACEAE.

Ulmus americana L. American Elm.
Throughout the state; being rare in the southern Eastern Shore, frequent in other portions of the Coastal Zone, preferring flood plains; frequent throughout the Midland Zone in flood plains and along streams, absent from the Mountain Zone.

Ulmus fulva Michx. Slippery Elm.
Distributed as is the preceding, the two often growing together. This species is somewhat the commoner of the two in the Upper Midland District, often growing in relatively dry soil.

Celtis occidentalis L. Hackberry.
Rare in the southern Eastern Shore, frequent in the remainder of the Coastal Zone and in the Midland, growing in moist and dry soil along streams, on the Upland and in the crevices of rocks.

Celtis crassifolia Lam. Hackberry.
Throughout the Midland Zone, being commoner than the preceding in the Upper Midland District, but similar in its tolerance of diverse conditions.

MORACEAE.

Morus rubra L. Red Mulberry.
Rare in the Southern Eastern Shore, infrequent throughout the remainder of the state, being most abundant in flood plains and rich upland forests.

Toxylon pomiferum Raf. Osage Orange.
Coastal and Midland Zones, a frequent escape from cultivation. Apparently not hardy in the Mountain Zone.

Broussonetia papyrifera (L.) Vent. Paper Mulberry.
Throughout the state, in cultivated grounds, introduced from Europe.

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Humulus lupulus L. Hop.
Upper Midland District, in dry thickets, infrequent.
Washington County, Weverton (1770).

URTICACEAE.

Urtica dioica L. Nettle.
Throughout the state; in waste grounds; common.

Urticastrum divaricatum (L.) Kuntze. Wood Nettle.
Throughout the state; in swamps, flood plains and moist forests; common.
Cecil County, North East (394).

Adicea pumila (L.) Raf. Richweed.
Throughout the state; in swamps and moist forests; common.

Boehmeria cylindrica (L.) Willd. False Nettle.
Throughout the state; in moist forests and open situations.
Cecil County, North East (391).

Parietaria pennsylvanica Muhl. Pennsylvania Pellitory.
Upper Midland District and Mountain Zone; in moist and dry forests; frequent.
Washington County, Hancock (831).

LORANTHACEAE.

Phoradendron flavescens (Pursh.) Nutt. American Mistletoe.
Common in the Coastal Zone, rare in the Midland Zone; parasitic on deciduous trees, preferring oaks and Red Maple.
Somerset County, near Pocomoke City (1150).

SANTALACEAE.

Comandra umbellata (L.) Nutt. Bastard Toad Flax.
Rare in the Coastal Zone; common in the Midland and Mountain Zones in dry forests and open situations, preferring sandy soil.
Washington County, near Hancock (800).

ARISTOLOCHIACEAE.

Asarum canadense L. Wild Ginger.
Rare in the Coastal Zone; common in the Midland and Mountain Zones in moist forests.

Aristolochia serpentaria L. Virginia Snakeroot.
Throughout the state; in moist forests; rare.
Caroline County, near Denton (1646).

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POLYGONACEAE.

Rumex acetosella L. Sheep Sorrel.
Throughout the state; in cultivated grounds; common.

Rumex verticillatus L. Swamp Dock.
Coastal Zone; in moist swamps and ponds; infrequent.
Dorchester County, Little Blackwater River (1598).

Rumex crispus L. Curled Dock.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Polygonum pennsylvanicum L. Pennsylvania Knotweed.
Throughout the state; in moist cultivated grounds; common.

Polygonum hydropiperoides Michx. Mild Water Pepper.
Throughout the state; in marshes, swamps and open wet situations; common.

Polygonum punctatum Ell. (*acre* H. B. K.) Water Smart-weed.
Throughout the state; in open situations; common.

Polygonum virginianum L. Virginia Knot-weed.
Throughout the state; in moist forests; frequent.

Polygonum aviculare L. Knot-grass.
Throughout the state; in cultivated grounds; common.

Polygonum amphibium L.
Coastal Zone.

Polygonum maritimum L. Seaside Knotweed.
Coastal Zone; in salt and brackish marshes; infrequent.
Worcester County, Ocean City (1230).

Polygonum erectum L.
Throughout the state; in cultivated and waste grounds; common.

Polygonum tenue Michx. Slender Knotweed.
Baltimore County, Bare Hills (Robert K. Miller).

Polygonum convolvulus L. Black Bindweed.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Polygonum scandens L. Climbing False Buckwheat.
Throughout the state; in cultivated grounds; frequent.

Polygonum sagittatum L. Arrow-leaved Tear-thumb.
Throughout the state; in marshes, swamps and open wet situations; common.

Polygonum arifolium L. Halberd-leaved Tear-thumb.
Throughout the state; in marshes, swamps and open wet situations; common.

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Polygonum hydropiper L. Smartweed.
Coastal Zone.

Polygonum persicaria L.
Coastal Zone, naturalized from Europe.

Polygonella articulata (L.) Meisn. Coast Jointweed.
Coastal and Midland Zones; in dry forests, preferring sandy soil.
Worcester County, near Wagram (1159).

CHENOPODIACEAE.

Chenopodium album L. Lamb's Quarters.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Chenopodium murale L. Nettle-leaved Goosefoot.
Throughout the state; in cultivated grounds frequent. Introduced from Europe.

Chenopodium anthelminticum L. Wormseed.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Atriplex hastata L. Halberd-leaved Orache.
Coastal Zone; growing on the strand and in salt and brackish marshes; common.

Atriplex rosea L. Red Orache.
Baltimore County, Canton; on ballast (Robert K. Miller).

Salicornia herbacea L. Slender Grasswort.
Coastal Zone; in salt and brackish marshes; common.

Salsola kali L.
Coastal Zone; on dunes and strand; frequent.

AMARANTHACEAE.

Amaranthus retroflexus L. Rough Pigweed.
Throughout the state; in waste grounds; common. Introduced from South America.

Amaranthus spinosus L. Spiny Amaranth.
Throughout the state; in cultivated grounds; common. Introduced from South America.

Amaranthus blitoides S. Wats. Prostrate Amaranth.
Baltimore County, Canton; on ballast (Robert K. Miller).

Acnida cannabina L. Water-hemp.
Coastal Zone; in salt and brackish marshes; frequent.
Caroline County, Dover Bridge (2066).

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PHYTOLACCACEAE.

Phytolacca decandra L. Poke.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

AIZOACEAE.

Mollugo verticillata L. Carpet-weed.
Throughout the state; in cultivated grounds; common.

PORTULACACEAE.

Talinum teretifolium Pursh. Fame-flower.
Midland Zone; confined to the serpentine barrens.

Claytonia virginica L. Spring Beauty.
Rare in the Coastal Zone, common in the Midland and Mountain Zones in moist forests.

Portulaca oleracea L. Purslane.
Throughout the state; in cultivated grounds. Introduced from Europe.

CARYOPHYLLACEAE.

Agrostemma githago L. (*Lychnis githago* Scop.) Corn Cockle.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Silene stellata (L.) Ait. Starry Campion.
Throughout the state; in dry forests; frequent.
Washington County, Sideling Hill (1793).

Silene alba Muhl. Western White Campion.
Baltimore County, Gunpowder River (Robert K. Miller).

Silene vulgaris (Moench.) Garcke. Bladder Campion.
Throughout the state; in cultivated grounds; infrequent.
Garrett County, Kelso Gap (494).

Silene antirrhina L. Sleepy Catchfly.
Montgomery County, Great Falls (1467a).

Silene noctiflora L. Night-flowering Catchfly.
Baltimore County, near Cockeysville (Robert K. Miller).

Silene dichotoma Ehrh. Forked Catchfly.
Baltimore County, near Cockeysville (Robert K. Miller).

Lychnis alba Mill. White Campion.
Throughout the state; in cultivated grounds; infrequent.
Caroline County, Denton (1638).

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Saponaria officinalis L. Soapwort.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Vaccaria vaccaria (L.) Britton. Cow-herb.
Throughout the state; in cultivated grounds; infrequent. Introduced from Europe.
Anne Arundel County, Odenton (1473).

Dianthus prolifer L. Proliferous Pink.
Anne Arundel County, Annapolis (M. A. Chrysler).

Alsine uliginosa (Murr.) Britton. Bog Starwort.
Cecil County, Port Deposit (J. K. Small).

Alsine media L. Common Chickweed.
Throughout the state; in moist forests and open situations; common.

Alsine pubera (Michx.) Britton. Great Chickweed.
Throughout the state; in moist forests and open situations; common.
Baltimore, Walbrook (429).

Alsine longifolia (Muhl.) Britton. Long-leaved Stichwort.
Throughout the state; in moist forests and open wet situations; frequent.
Baltimore County, Towson (474).

Cerastium longipedunculatum Muhl. Nodding Chickweed.
Allegany County, Cumberland (Howard Shriver).

Cerastium arvense L. Field Chickweed.
Midland Zone; confined to the serpentine barrens.
Baltimore County, Soldiers Delight (1409).

Cerastium arvense var. **oblongifolium** (Torr.) Holl.
Midland Zone; in dry forests and open situations.
Cecil County, Conowingo (413).

Sagina procumbens L.
Throughout the state; in dry cultivated and waste grounds; frequent.
Baltimore (W. Ralph Jones).

Arenaria serpyllifolia L. Thyme-leaved Sandwort.
Throughout the state; in open dry situations.
Allegany County, Braddock Run (890).

Moehringia lateriflora (L.) Fenzl. Blunt-leaved Moehringia or Sandwort.
Garrett County, Oakland (563).

Ammodenia peploides (L.) Ruper. Sea-beach Sandwort.
Coastal Zone; on the strand; rare.
Worcester County, Ocean City (M. A. Chrysler).

Tissa marina (L.) Britton. Salt-marsh Sand Spurry.
Coastal Zone; in salt and brackish marshes and in cultivated grounds subject to tidal overflow; frequent.

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Anychia dichotoma Michx. Forked Chickweed.
Throughout the state; in moist and dry forests; common.
Wicomico County, Tonytank Creek (1195).

Anychia canadensis (L.) B. S. P.
Baltimore, Druid Hill Park (W. Ralph Jones).

NYMPHAEACEAE

Brasenia purpurea (Michx.) Casp. Water-shield.
Throughout the state; in ponds and slow streams; infrequent.

Nymphaea advena Soland. Yellow Pond Lily.
Throughout the state; in ponds and slow streams, being particularly characteristic of the margins of marshes on the upper waters of tidal rivers in the Coastal Zone.

Castalia odorata (Dryand.) Woodv. & Wood. White Water Lily.
Coastal and Midland Zones; in ponds and slow streams; frequent.

CERATOPHYLLACEAE.

Ceratophyllum demersum L. Hornwort.
Coastal Zone; in slow streams and the upper waters of tidal rivers frequent.
Dorchester County, Little Blackwater River (1596).

MAGNOLIACEAE.

Magnolia tripetala L. Umbrella Tree.
Known only from the Midland Zone, where it grows singly or in small groups on flood plains or on rich mountain slopes; rare.

Magnolia virginiana L. Laurel Magnolia.
Confined to the Coastal Zone; in river swamps, stream swamps and upland swamps, being more abundant in wet sandy soil and found also in wet clay; common.

Magnolia acuminata L. Cucumber-tree.
Occurs rarely in the Coastal Zone, is occasional in the lower Midland District and frequent in the upper Midland District and Mountain Zone, preferring deep soils of lower mountain slopes.

Liriodendron tulipifera L. Tulip-tree.
Common in the Coastal Zone, where it is infrequent in the river swamps, frequent in flood plains and infrequent in moist upland forests; common in the Midland Zone in the flood plains and swamps, rare in the Mountain Zone.

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ANONACEAE.

Asimina triloba (L.) Dunal. Paw Paw.
Coastal and Midland Zones; being rare in the Coastal Zone in flood plains, infrequent in the Midland Zone.

RANUNCULACEAE.

Caltha palustris L. Marsh-marigold.
Midland and Mountain Zones; in swamps; infrequent.
Garrett County near Oakland (484).

Caltha flabellifolia Pursh. Mountain Marsh-marigold.
Mountain Zone; in swamps; rare.
Garrett County near Finzel (George M. Perdew).

Coptis trifolia (L.) Salisb. Gold-thread.
Mountain Zone; in moist forests near the edges of bogs; rare.
Garrett County, Thayerville (2058).

Actaea alba (L.) Mill. White Baneberry.
Midland and Mountain Zones; in moist forests; infrequent.
Garrett County, Kelso Gap (2040).

Cimicifuga racemosa (L.) Nutt. Black Snakeroot.
Rare in the Coastal Zone; common in the Midland and Mountain Zones; in moist and dry forests.

Cimicifuga americana Michx. American Bugbane.
Mountain Zone; in moist forests; rare.
Garrett County, Kelso Gap (2038).

Aquilegia canadensis L. Wild Columbine.
Rare in the Coastal Zone; common in the Midland and Mountain Zones in moist forests and on rocky slopes.
Garrett County, Oakland (485).

Delphinium consolida L. Field Larkspur.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Delphinium ajacis L.
In cultivated grounds; infrequent. Introduced from Europe.
Charles County, Chapel Hill (M. A. Chrysler).

Delphinium urceolatum Jacq. Tall Larkspur.
Midland and Mountain Zones; in dry forests; infrequent.
Washington County, Round Top (706).

Aconitum uncinatum L. Wild Monkshood.
Mountain Zone; in open moist situations; frequent.
Garrett County near Oakland (2015).

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Anemone virginiana L. Tall Anemone.
Rare in the lower Midland District, common in the upper Midland District and Mountain Zone, in moist forests.

Anemone quinquefolia L. Wind-flower.
Midland and Mountain Zones; in moist forests; infrequent.

Anemone trifolia L. Mountain Anemone.
Mountain Zone; in moist forests; infrequent.
Garrett County, Oakland (George M. Perdew).

Hepatica hepatica (L.) Karst. Hepatica.
Rare in the Coastal Zone; common in the Midland and Mountain Zones; in moist and dry forests.

Hepatica acuta (Pursh.) Britton.
Mountain Zone; in moist forests; rare.
Garrett County, Boiling Spring (2044).

Syndesmon thalictroides (L.) Hoffmg. Rue-anemone.
Rare in the Coastal Zone, common in the Midland and Mountain Zones; in moist forests.

Clematis virginiana L. Virgin's Bower.
Common throughout the state; in moist and dry forests and open situations.
Cecil County, Elkton (419).

Clematis viorna L. Leather-flower.
Midland and Mountain Zones; in moist forests; infrequent in the Lower Midland District; frequent in the Upper Midland District and Mountain Zone.
Washington County, Round Top (724).

Trautvetteria carolinensis (Walt.) Vail. False Bugbane.
Known from the Midland Zone only in the vicinity of the Great Falls, Montgomery County, frequent in the Mountain Zone; in moist soil and clefts of rock along streams.
Garrett County, Swallow Falls (566).

Ranunculus obtusiusculus Raf. Water Plantain Spearwort.
Queen Anne's County, near Sudlerville (1668).

Ranunculus abortivus L. Kidney-leaved Crowfoot.
Throughout the state; in moist forests; common.

Ranunculus abortivus L. Celery-leaved Crowfoot.
Throughout the state; in moist forests and open wet situations; common.
Talbot County, near Easton (1514).

Ranunculus recurvatus Poir. Hooked Crowfoot.
Calvert County, Chesapeake Beach (Joseph H. Painter).

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Ranunculus acris L. Tall or Meadow Buttercup.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Ranunculus bulbosus L. Bulbous Buttercup.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Ranunculus pennsylvanicus L. f.
Baltimore, Druid Hill Park (W. Ralph Jones).

Ranunculus septentrionalis Poir. Swamp or Marsh Buttercup.
Baltimore County, Gunpowder River (Robert K. Miller).

Batrachium hederaceum (L.) S. F. Gray. Ivy-leaved Crowfoot.
Prince George's County, Mt. Calvert (1556).

Thalictrum dioicum L. Early Meadow-Rue.
Throughout the state; in moist forests and open situations; common.

Thalictrum polygamum Muhl. Tall Meadow-Rue.
Anne Arundel County, Annapolis (M. A. Chrysler).

Thalictrum purpurascens L. Purple Meadow-Rue.
Coastal Zone.

BERBERIDACEAE.

Caulophyllum thalictroides (L.) Michx. Blue Cohosh.
Rare in the Midland Zone; common in the Mountain Zone; in moist forests.
Garrett County, Boiling Spring (1964).

Jeffersonia diphylla (L.) Pers. Twin-leaf.
Rare in the Midland Zone; infrequent in the Mountain Zone; in moist forests.

Podophyllum peltatum L. May Apple.
Throughout the state; in moist forests and open situations; common.

MENISPERMACEAE.

Menispermum canadense L. Canada Moonseed.
Rare in the Coastal Zone; frequent in the Midland Zone; in moist forests.

LAURACEAE.

Sassafras sassafras (L.) Karst. Sassafras.
Common in the Coastal and Midland Zones; rare in the Mountain Zone.
Talbot County, Easton (1371).

Benzoin benzoin (L.) Coulter. Spice-bush.
Throughout the state; in swamps, flood plains and moist forests; common.

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PAPAVERACEAE.

Sanguinaria canadensis L. Bloodroot.
Midland Zone.

Papaver somniferum L. Opium or Garden Poppy.
Baltimore, waste lots (Robert K. Miller).

Papaver dubium L. Long Smooth-fruited Poppy.
Throughout the state; in cultivated grounds; infrequent. Introduced.

Argenmone mexicana L. Mexican or Prickly Poppy.
Coastal and Midland Zones; in waste grounds; rare.
Caroline County, Denton (Forrest Shreve); Prince George's County, Nottingham (Robert K. Miller).

Chelidonium majus L. Celandine.
Rare in the Coastal Zone; frequent in the Midland and Mountain Zones; in flood plains and moist forests.

Bicuculla cucullaria (L.) Millsp. Dutchman's Breeches.
Rare in the Coastal Zone; frequent in the Midland and Mountain Zones; in forests and open situations.

Bicuculla canadensis (Goldie) Millsp. Squirrel Corn.
Mountain Zone; in the crevices of rocky cliffs; frequent.
Allegany County, Cumberland (1937).

Bicuculla eximia (Ker.) Millsp. Wild Bleeding Heart.
Mountain Zone.

Adlumia fungosa (Ait.) Greene. Climbing Fumitory.
Upper Midland District and Mountain Zone; on rocky slopes; infrequent.
Frederick County, Thurmont (1758)

Capnoides sempervirens (L.) Borck. Pink Corydalis.
Rare in the Midland Zone; infrequent in the Mountain Zone; growing on rocky boulders. Garrett County, near Swanton (2007).

Capnoides flavulum (Raf.) Kuntze. Pale Corydalis.
Rare in the Coastal Zone; infrequent in the Midland and Mountain Zones; in moist forests. Montgomery County, Great Falls (1412).

Glaucium glaucium (L.) Karst. Sea Poppy.
Coastal Zone.

CRUCIFERAE.

Lepidium campestre (L.) MR. Br. Field Cress.
Throughout the state; in cultivated grounds; common. Introduced.

Lepidium virginicum L. Wild Peppergrass.
Throughout the state; in cultivated grounds; common.

Sisymbrium officinale (L.) Scop. Hedge Mustard.
Throughout the state; in cultivated grounds; common. Introduced.

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Cakile edentula (Bigel.) Hook. American Sea Rocket.
Coastal Zone; on the strand; frequent.
Worcester County, Ocean City (1252).

Sinapis alba L. White Mustard.
Throughout the state; in cultivated grounds and waste places; common. Introduced from Europe.

Brassica nigra (L.) Koch. Black Mustard.
Throughout the state; in cultivated grounds and waste places; common. Introduced from Europe.

Brassica arvensis (L.) B. S. P. Charlock.
Throughout the state; in cultivated grounds and waste places; frequent. Introduced from Europe.

Barbarea barbarea (L.) MacM. Yellow Cress.
Throughout the state; in cultivated grounds and waste places; common. Introduced from Europe.

Barbarea praecox (J. E. Smith) R. Br. Early Winter.
Throughout the state; in cultivated grounds and waste places; frequent.
Allegany County, Cumberland (Howard Shriver).

Roripa sylvestrix (L.)Bess. Creeping Yellow Water Cress.
Baltimore County, Middle River (M. A. Chrysler).

Roripa nasturtium (L.) Rusby. Water-cress.
Throughout the state; in streams and open wet situations; common. Introduced from Europe.

Cardamine pennsylvanica Muhl. Pennsylvania Bitter-cress.
Montgomery County, Great Falls (Joseph H. Painter).

Cardamine purpurea (Torr.) Britton. Purple Cress.
Throughout the state; in flood plains and moist forests.
Baltimore County, Soldiers Delight (1419).

Cardamine rotundifolia Michx. Round-leaved Water-cress.
Allegany County, Cumberland (Howard Shriver).

Dentaria laciniata Muhl. Cut-leaved Toothwort.
Infrequent in the Midland Zone; frequent in the Mountain Zone; in moist forests.
Baltimore County, Western Run (1404).

Dentaria diphylla Michx. Two-leaved Toothwort.
Rare in the Midland Zone; frequent in the Mountain Zone; in moist forests.
Garrett County, Kelso Gap (564).

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Dentaria heterophylla Nutt. Slender Toothwort.
Midland Zone; in moist forests; infrequent.
Baltimore County, near Bare Hills (W. Ralph Jones).

Bursa bursa-pastoris (L.) Britton. Shepherd's Purse.
Throughout the state; in cultivated grounds and waste places; common.
Introduced from Europe.

Camelina sativa (L.) Crantz.
Baltimore County, near Cockeysville (Robert K. Miller).

Draba verna L. Vernal Whitlow-grass.
Throughout the state; in open situations; common.
Talbot County, Easton (1358).

Draba ramosissima Deav. Branching Whitlow-grass.
Washington County, Round Top (717).

Stenophragma thaliana (L.) Celak. Mouse-ear or Thale-cress.
Throughout the state; in cultivated grounds and waste places; frequent.
Introduced from Europe.

Arabis lyrata L. Lyre-leaved Rock-cress.
Throughout the state; in open dry situations; common.
Baltimore County, Soldiers Delight (1410).

Arabis dentata T. & G. Toothed Rock-cress.
Montgomery County, Cabin John (Joseph H. Painter).

Arabis laevigata (Muhl.) Poir. Smooth Rock-cress.
Baltimore County, Towson (Robert K. Miller).

Arabis canadensis L. Sickle-pod.
Midland and Mountain Zones; in moist fields; infrequent.
Garrett County, Kelso Gap (567).

Erysimum cheiranthoides L. Worm-seed or Treacle Mustard.
Allegany County, Cumberland (Howard Shriver).

Berteroa incana (L.) DC. Hoary Alyssum.
Baltimore County, Frederick Road (Jos. H. Brummell).

CAPPARIDACEAE.

Cleome spinosa L. Spider-flower.
Allegany County, Cumberland (Howard Shriver).

Polanisia graveolens Raf. Clammy-weed.
Kent County, Lloyds Creek (1704).

RESEDACEAE.

Reseda lutea L. Yellow Cut-leaved Mignonette.
Baltimore County, Canton; on ballast (Robert K. Miller).

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SARRACENIACEAE.

Sarracenia purpurea L. Pitcher Plant, Side-saddle Flower.
Anne Arundel County, Glenburnie (M. A. Chrysler).

DROSERACEAE.

Drosera rotundifolia L. Round-leaved Sundew.
Common in moist sandy forests in the Coastal Zone; infrequent in moist sandy forests and bogs in the Midland and Mountain Zones.

Drosera intermedia Hayne. Spatulate-leaved Sundew.
Growing with the former plant and more common than it.

PODOSTEMACEAE.

Podostemon ceratophyllum Michx. River-weed.
Baltimore County, Western Run (Robert K. Miller).

CRASSULACEAE.

Sedum telephium L. Orpine.
Midland Zone; on open rocky slopes; infrequent. Introduced from Europe.
Baltimore County, near Towson (Robert K. Miller).

Sedum telephioides Michx. American Orpine.
Midland and Mountain Zones; on open rocky slopes; common.
Allegany County, Flintstone (1026a).

Sedum acre L. Wall-pepper.
Washington County, Williamsport (1809a).

Sedum ternatum Michx. Wild Stonecrop.
Midland and Mountain Zones; in moist forests and on rocky slopes; frequent.
Washington County, Round Top (707).

Penthorum sedoides L. Virginia Stonecrop.
Throughout the state; in moist forests and open situations; frequent.

SAXIFRAGACEAE.

Tiarella cordifolia L. False Mitrewort.
Mountain Zone.

Saxifraga pennsylvanica L. Swamp Saxifrage.
Rare in the Midland Zone; frequent in the Mountain Zone; in moist forests and along streams.
Garrett County, near Finzel (George M. Perdew).

Saxifraga micranthidifolia (Haw.) B. S. P. Lettuce Saxifrage.
Mountain Zone; in moist forests and along streams.
Garrett County, Kelso Gap (488).

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Saxifraga virginiensis Michx. Early Saxifrage.
Rare in the Coastal Zone, in ravine slopes; common in the Midland and Mountain Zones; in dry forests and on boulders.
Garrett County, Kelso Gap (507).

Heuchera americana L. Alumroot.
Rare in the Coastal Zone; common in the Midland and Mountain Zones in moist and dry forests.

Heuchera pubescens Pursh. Downy Heuchera.
Upper Midland District and Mountain Zone; in moist forests; infrequent.
Allegany County, Cumberland (George M. Perdew).

Mitella diphylla L. Bishop's Cap.
Midland and Mountain Zones; in moist forests; infrequent.

Chrysosplenium americanum Schwein. Golden Saxifrage.
Throughout the state; in swamps and flood plains; common.

Hydrangea arborescens L. Wild Hydrangea.
Rare in the Coastal Zone, common in the Midland and Mountain Zones; in moist forests and along streams.

Itea virginica L. Virginia Willow.
Coastal Zone.

GROSSULARIACEAE.

Ribes cynosbati L. Wild Gooseberry.
Midland and Mountain Zones; in moist and dry forests; frequent.
Allegany County, Piney Mountain (910).

Ribes rotundifolium Michx. Eastern Wild Gooseberry.
Midland and Mountain Zones; in dry forests; frequent.
Allegany County, Cumberland (868).

HAMAMELIDACEAE.

Hamamelis virginiana L. Witch Hazel.
Throughout the state; being rare in the Coastal Zone, common in the Midland and Mountain Zones; in moist forests and flood plains.

Liquidambar styraciflua L. Sweet Gum.
Confined to the Coastal Zone; where it is one of the commonest of the forest trees, growing in a variety of situations, but being most abundant in upland swamps. It reproduces readily by suckers as well as by seeds, and is one of the most prominent species in the reforesting of abandoned areas.

PLATANACEAE.

Platanus occidentalis L. Button wood.
Throughout the Coastal and Midland Zones; along streams and on flood plains; common. In the upper Midland Zone it is occasionally found on slopes and in relatively dry situations.

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ROSACEAE.

Opulaster opulifolius (L.)Kuntze. Ninebark.
Midland and Mountain Zones; along streams.
Washington County, Hancock (745).

Spiraea salicifolia L. Willow-leaved Meadow-Sweet.
Throughout the state; along streams and in open moist situations, being common in the Midland and Mountain Zones.
Montgomery County, Gaithersburg (1735).

Spiraea tomentosa L. Hardhack.
Throughout the state; along streams and in open moist situations; infrequent.
Worcester County, Boxiron (1064).

Spiraea corymbosa Raf. Corymbed Spiraea.
Upper Midland District and Mountain Zone; in dry forests; infrequent.
Washington County, near Rohrersville (1768).

Porteranthus trifoliatus (L.) Britton. Indian Physic.
In Cecil County and throughout the Midland and Mountain Zones; in dry forests and open situations; common.

Rubus odoratus L. Purple-flowering Raspberry.
Upper Midland District and Mountain Zone; in dry forests, preferring rocky slopes among sandstone boulders; frequent.
Allegany County, Cumberland (867).

Rubus occidentalis L. Black Raspberry.
Throughout the state; in moist forests and flood plains; common.

Rubus alleghaniensis Porter. Mountain Blackberry.
Upper Midland District and Mountain Zone; in dry forests and open situations; frequent.

Rubus cuneifolius Pursh. Sand Blackberry.
Coastal Zone; in open dry situations; preferring sandy soil; common in the southern counties of the Eastern Shore, not observed north of Greensborough, Caroline County.
Worcester County, Snow Hill (1051).

Rubus villosus Ait. Bush Blackberry.
Coastal Zone.

Rubus hispidus L. Swamp Blackberry.
Throughout the state; in moist forests; swamps and bogs; common.

Rubus canadensis L. Low Running Blackberry.
Throughout the state; in dry open situations; common.

Dalibarda repens L. Dalibarda.
Mountain Zone; in moist forests and swamps; frequent.
Garrett County, Boiling Spring (1965).

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Fragaria virginiana Duchesne. Wild Strawberry.
Throughout the state; in open dry situations; common.

Duchesnea indica (Andr.) Focke. Indian Strawberry.
Throughout the state; in cultivated grounds; infrequent. Introduced from India.

Potentilla monspeliensis L. Rough Cinquefoil.
Throughout the state; in open dry situations, being most frequent in the Coastal Zone.

Potentilla canadensis L. Five-finger.
Throughout the state; in moist and dry forests; common.
Garrett County, Oakland (480).

Waldsteinia fragarioides (Michx.) Tratt. Dry Strawberry.
Mountain Zone; in moist forests; infrequent.
Garrett County, Boiling Spring (1960).

Geum canadense Jacq. White Avens.
Throughout the state; in moist forests; common.
Washington County, Sideling Hill (798).

Geum virginianum L. Rough Avens.
Throughout the state; in moist forests and swamps; frequent.
Baltimore County, near Cockeysville (Robert K. Miller).

Ulmaria rubra Hill.
Baltimore County, Timonium (Robert K. Miller).

Agrimonia pumila Muhl. Small-fruited Agrimony.
Washington County, near Hancock (Frederick H. Blodgett).

Agrimonia parviflora Soland. Many-flowered Agrimony.
Throughout the state; in open situations; common.

Sanguisorba sanguisorba (L.) Britton. Salad Burnet.
Midland Zone; in waste situations; infrequent.
Prince George's County, Upper Marlborough (Robert K. Miller).

Sanguisorba canadensis L. American Great Burnet.
Midland Zone; in open moist situations; rare.

Rosa carolina L. Swamp Rose.
Throughout the state; in moist swamps and open moist situations, being most common in the Coastal Zone.
Dorchester County, Little Blackwater River (1601).

Rosa humilis Marsh. Low or Pasture Rose.
Throughout the state; in dry situations; frequent.
Anne Arundel County, Odenton (Joseph H. Painter).

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Rosa canina L. Dog Rose.
Midland and Mountain Zones; in open situations; frequent.
Allegany County, near Cumberland (876).

POMACEAE.

Sorbus americana Marsh. Mountain Ash.
Confined to the Mountain Zone; in swamps and on rocky slopes; frequent.
Garrett County, near Swanton (2009).

Aronia arbutifolia (L.) Ell. Red Choke-berry.
Throughout the state; in moist forests and swamps; common.

Aronia atropurpurea Britton.
Mountain Zone; in open wet situations.
Garrett County, Big Savage Mountain (852).

Aronia nigra (Willd.) Britton. Black Choke-berry.
Mountain Zone; in swamps and bogs; frequent.
Garrett County, Thayerville (2054).

Amelanchier canadensis (L.) Medic. June-berry.
Coastal and Midland Zones; in dry forests, preferring rocky slopes and being most common in the Midland Zone.

Crataegus crus-galli L. Cockspur Thorn.
Throughout the state; in dry forests and open situations; common.

Crataegus coccinea L. Scarlet Haw.
Upper Midland District.

Crataegus brownii Britton.
Allegany County, Cumberland (875).

Crataegus punctata Jacq.
Allegany County, Braddock Run (903).

Crataegus oxyacantha L. Hawthorn.
Throughout the state; in open situations; being most common in the Mountain Zone. Introduced from Europe.

Crataegus tenuifolia Britton.
Allegany County near Flintstone (1021).

Crataegus uniflora Muench. Dwarf Thorn.
Coastal Zone; in dry forests, preferring sandy soil; infrequent.

DRUPACEAE.

Prunus pennsylvanica L. f. Wild Red Cherry.
Throughout the state; usually growing as single trees in open situations; frequent.

Prunus serotina Ehrh. Wild Black Cherry.
Throughout the state; in forests and open situations; common.

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CAESALPINACEAE.

Cercis canadensis L. Red-bud.
Rare in the Coastal Zone, where it is found on gravel slopes underlaid by clay; common in the Midland Zone, where it grows chiefly on slopes bordering streams and on rocky slopes. It is particularly abundant in the forests of the limestone region. It is apparently absent from the Mountain Zone.

Cassia nictitans L. Sensitive Pea.
Throughout the state; in open dry situations; common.

Cassia chamaecrista L. Partridge Pea.
Throughout the state; in open dry situations; being most common in the light soils of the Coastal Zone.

Cassia marylandica L. Wild or American Senna.
Throughout the state; in flood plains and along streams; frequent.
Cecil County, Charlestown (400).

Gleditsia triacanthos L. Honey or Sweet Locust.
Throughout the state; being most frequent in the Upper Midland District. Introduced from Europe.

PAPILIONACEAE.

Baptisia australis (L.) R. Br. Blue Wild Indigo.
Washington County, flood plain of the Potomac at Williamsport (1805).

Baptisia tinctoria (L.) R. Br. Wild Indigo.
Throughout the state; in dry forests and open situations, being most common in sandy soil.

Crotalaria sagittalis L. Rattle-box.
Infrequent in the Coastal Zone, not observed elsewhere in the state; in open dry situations.
Anne Arundel County, Annapolis (M. A. Chrysler).

Lupinus perennis L. Wild Lupine.
Throughout the state; in dry forests, being most abundant on the light soils of the Western Shore District of the Coastal Zone.

Cytisus scoparius (L.) Link. Scotch Broom.
In cultivated grounds; introduced from Europe.
Anne Arundel County, Annapolis (M. A. Chrysler).

Medicago sativa L. Purple Medic.
Throughout the state; in cultivated grounds and waste places; common. Introduced from Europe.

Medicago lupulina L. Black or Hop Medic.
Throughout the state; in cultivated grounds and waste places; common. Introduced from Europe.

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Melilotus alba Desv. White Melilot.
Throughout the state; in cultivated grounds and waste places; common. Introduced from Europe.

Melilotus officinalis (L.) Lam. Yellow Melilot.
Throughout the state; in cultivated grounds and waste places; frequent. Introduced from Europe.

Trifolium agrarium L. Yellow or Hop Clover.
Throughout the state; in cultivated grounds and waste places; common. Introduced from Europe.

Trifolium procumbens L. Low Hop Clover.
Throughout the state; in cultivated grounds and waste places; common. Introduced from Europe.

Trifolium arvense L. Rabbit-foot Clover.
Throughout the state; in cultivated grounds and waste places; common. Introduced from Europe.

Trifolium pratense L. Red Clover.
Throughout the state; in cultivated grounds and waste places; common. Introduced from Europe.

Trifolium hybridum L. Alsike, or Alsatian Clover.
Throughout the state; in cultivated grounds and waste places; common.

Trifolium repens L. White Clover.
Throughout the state; in cultivated grounds and waste places; common.

Lotus corniculatus L. Bird's-foot Trefoil.
Baltimore County, Canton, on ballast (Robert K. Miller).

Cracca virginiana L. Cat-gut.
Throughout the state; in dry forests, preferring light soils.

Cracca spicata (Walt.)Kuntze. Goat's Rue.
Coastal Zone; in dry, open forests; rare.
Wicomico County, Salisbury (1276).

Robinia pseudacacia L. Yellow Locust.
Throughout the state; an introduced tree which is particularly abundant in cut-over forests and in waste grounds, but has spread so abundantly in the forests, particularly of the Midland Zone, as to appear to be native.

Astragalus carolinianus L. Milk Vetch.
Midland and Mountain Zones; in dry forests and open situations; infrequent.
Washington County, Round Top (725).

Coronilla varia L. Coronilla.
Baltimore County, Worthington Valley (Dr. B. W. Barton).

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Aeschynomene virginica (L.) B. S. P. Joint Vetch.
Coastal Zone; in the fresh marshes of tidal rivers; infrequent.
Wicomico County, near Vienna (1297).

Stylosanthes biflora (L.) B. S. P. Pencil flower.
Throughout the state in dry forests, preferring sandy soil; common in the Coastal Zone, infrequent in the Midland and Mountain Zones.

Meibomia nudiflora (L.) Kuntze. Tick Trefoil.
Throughout the state; in dry forests; common.
Wicomico County, Salisbury (1220).

Meibomia grandiflora (Walt.) Kuntze.
Throughout the state: in dry forests and open situations; frequent.
Allegany County, Cumberland (872).

Meibomia arenicola Vail.
Calvert County, Solomons (M. A. Chrysler).

Meibomia michauxii Vail.
Coastal and Midland Zones; in dry forests; common in the Coastal Zone, infrequent in the Midland Zone.
St. Mary's County, Leonardtown (M. A. Chrysler).

Meibomia canescens (L.) Kuntze.
Throughout the state; in moist forests; frequent.
Allegany County, near Cumberland (1000).

Meibomia paniculata (L.) Kuntze.
Throughout the state; in dry forests and open situations; common.

Meibomia viridiflora (L.) Kuntze.
Common in the Coastal Zone, infrequent in the Midland Zone; in dry forests and open situations.
Prince George's County, Upper Marlborough (M. A. Chrysler).

Meibomia dillenii (Darl.) Kuntze.
Frequent in the Coastal Zone, infrequent in the Midland; in dry forests.
Anne Arundel County, West River (M. A. Chrysler).

Meibomia marylandica (L.) Kuntze.
Common in the Coastal Zone, infrequent in the Midland Zone; in dry forests.
Wicomico County, Tonytank Creek (1185).

Meibomia obtusa (Muhl.) Vail.
Coastal and Midland Zones; in dry forests and open situations; common.
Wicomico County, near Vienna (1342).

Lespedeza repens (L.) Bart. Bush Clover.
Throughout the state, being most abundant in the light soils of the Coastal Zone.

Lespedeza stuvei Nutt.
Coastal Zone.

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Lespedeza procumbens Michx.
Common in the Coastal Zone, infrequent in the Midland Zone; in dry Upland forests.

Lespedeza nuttallii Darl.
Throughout the state; in dry forests and open situations; infrequent.
Allegany County, Flintstone (1030).

Lespedeza violacea (L.) Pers.
Throughout the state; in dry forests; frequent.

Lespedeza virginica (L.) Britton.
Throughout the state; in dry forests and open situations; frequent.
Harford County, Havre De Grace (M. A. Chrysler).

Lespedeza hirta (L.) Ell.
Common in the Coastal Zone, infrequent in the Midland and Mountain Zones, preferring dry sandy soil.
Wicomico County, Salisbury (1263).

Lespedeza capitata Michx.
Calvert County, Chesapeake Beach (M. A. Chrysler).

Lespedeza angustifolia (Pursh.) Ell.
Infrequent in the Coastal Zone, in dry sandy soil.
Wicomico County, opposite Vienna (1339).

Lespedeza striata (Thumb.) H. & A. Japan Clover.
Throughout the state; in cultivated grounds and along roadsides; common. Introduced from Asia.

Vicia caroliniana Walt. Carolina Vetch.
Montgomery County, Great Falls (Robert K. Miller).

Vicia sativa L. Common Vetch, Tare.
Throughout the state; in cultivated grounds and roadsides; common. Introduced from Europe.

Vicia angustifolia Roth. Smaller Common Vetch.
Infrequent throughout the state in cultivated grounds. Introduced from Europe.
Baltimore, Walbrook (W. Ralph Jones).

Lathyrus venosus Muhl. Veiny Pea.
Montgomery County, Great Falls (464).

Bradburya virginiana (L.) Kuntze. Spurred Butterfly Pea.
Coastal Zone.

Clitoria mariana L. Butterfly Pea.
Frequent in the Coastal Zone, rare in the Midland Zone; in dry forests, preferring sandy soil.
Washington County, near Rohrersville (1784).

Falcata comosa (L.) Kuntze. Wild Pea-nut.
Throughout the state; in moist forests and flood plains; common.

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Apios apios (L.) MacM. Ground-nut.
Coastal and Midland Zones; in moist forests and open situations; frequent.

Galactia regularis (L.) B. S. P. Milk Pea.
Anne Arundel County, near Elvaton (Robert K. Miller).

Galactia volubilis (L.) Britton. Downy Milk Pea.
Anne Arundel County, Odenton (M. A. Chrysler).

Rhynchosia erecta (Walt.) DC.
Coastal Zone; in dry sandy forests and open situations; infrequent.
Wicomico County, Tonytank Creek (1196).

Strophostyles helvola (L.) Britton. Trailing Wild Bean.
Common in the Coastal Zone, rare in the Midland; in dry open situations.

Strophostyles umbellata (Muhl.) Britton. Pink Wild Bean.
Common in the Coastal Zone; infrequent in the Midland; in dry open situations.

GERANIACEAE.

Geranium maculatum L. Wild Crane's-bill.
Rare in the Coastal Zone; common in the Midland and Mountain Zones; in moist and dry forests.

Geranium columbinum L. Long-stalked Crane's-bill.
Infrequent in the northern Eastern Shore and Lower Midland District, in forests and open situations.
Queen Anne's County, near Sudlersville (1679).

Geranium carolinianum L. Carolina Crane's-bill.
Throughout the state in dry open situations and cultivated grounds; common.

OXALIDACEAE.

Oxalis acetosella L. White Wood-sorrel.
Throughout the state in moist forests and in open situations; common.
Garrett County, Swanton (499).

Oxalis stricta L. Upright Yellow Wood-sorrel.
Throughout the state; in moist forests and open situations; common.

Oxalis cymosa Small. Tall Yellow Wood-sorrel.
Calvert County, Chesapeake Beach (Joseph H. Painter).

Oxalis stricta L. Upright Yellow Wood-sorrel.
Midland Zone; in moist forests and open situations; frequent along the Potomac river.
Washington County, Hancock (744).

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LINACEAE.

Linum virginianum L. Slender Yellow Flax.
Throughout the state; in moist and dry situations; being most common in the Midland District.
Allegany County, near Cumberland (968).

Linum medium (Planch.) Britton. Stiff Yellow Flax.
Throughout the state; in moist open situations; being most common in the Coastal Zone and apparently absent from the Upper Midland District and Mountain Zone.
Worcester County, Herring creek (641).

RUTACEAE.

Ptelea trifoliata L. Hop Tree.
Midland and Mountain Zones; in the deep soil of mountain slopes and in moist rocky slopes; infrequent.
Washington County, Round Top (707a).

SIMARUBACEAE.

Ailanthus glandulosa Desf. Ailanthus, Tree of Heaven.
Commonly escaped from cultivation throughout the state. Naturalized from Asia.

POLYGALACEAE.

Polygala lutea L. Orange Milkwort.
Coastal Zone; in moist sandy situations; frequent.
Worcester County, Berlin (662).

Polygala cruciata L. Cross-leaved Milkwort.
Throughout the state; in moist sandy situations; frequent.
Cecil County, Hog Hills (370).

Polygala verticillata L. Whorled Milkwort.
Throughout the state; in forests and open situations; common.

Polygala ambigua Nutt. Loose-spiked Milkwort.
Throughout the state; in dry forests and open situations; common.
Cecil County, Elkton (371).

Polygala incarnata L. Pink Milkwort.
Coastal and Midland Zones; in dry open situations; infrequent.
Cecil County, Elkton (369).

Polygala viridescens L. Purple Milkwort.
Throughout the state in moist open situations; common.
Allegany County, near Cumberland (945).

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Polygala mariana Mill. Maryland Milkwort.
Throughout the state; in open forests and dry situations; common.
Cecil County, Elkton (368).

Polygala nuttallii T. & G. Nuttall's Milkwort.
Coastal and Midland Zones; in dry forests and open situations; frequent.
Cecil County, Hog Hills (367).

Polygala senega L. Seneca Snakeroot.
Midland and Mountain Zones; in dry forests; rare.
Baltimore, Gwynn Oak (W. Ralph Jones).

Polygala paucifolia Willd. Fringed Milkwort.
Allegany County, Cumberland (George M. Perdew).

EUPHORBIACEAE.

Phyllanthus carolinensis Walt. Phyllanthus.
Midland Zone; in dry situations; rare.
Allegany County, Cumberland (Howard Shriver).

Crotonopsis linearis Michx. Crotonopsis.
Coastal Zone; in dry forests and open situations; infrequent.
Wicomico County, Salisbury (1222).

Acalypha virginica L. Three-seeded Mercury.
Throughout the state; in moist forests and cultivated grounds; common.

Acalypha gracilens A. Gray.
Throughout the state; in forests and cultivated grounds; frequent.

Euphorbia polygonifolia L. Seaside Spurge.
Coastal Zone; on the strand and dunes of the ocean front and at several localities on Chesapeake Bay.
Worcester County, Ocean City (1244).

Euphorbia maculata L. Spotted Spurge.
Throughout the state; in cultivated grounds and open dry situations; common.

Euphorbia nutans Lag. Large Spotted Spurge.
Throughout the state; in cultivated grounds and waste places; common.

Euphorbia marylandica Greene.
Anne Arundel County, Odenton (Robert K. Miller).

Euphorbia corollata L. Flowering Spurge.
Coastal and Midland Zones; in dry forests and open situations, being most abundant in the light soils of the Coastal Zone.

Euphorbia dentata Michx. Toothed Spurge.
Throughout the state; in waste grounds; infrequent.
Allegany County, Cumberland (1918).

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Euphorbia ipecacuanhae L. Ipecac Spurge, Wild Ipecac.
Coastal Zone; in dry forests and open situations, being most abundant on sandy soil; common.
Worcester County, Snow Hill (1045).

Euphorbia darlingtonii A. Gray. Darlington's Spurge.
Baltimore, Walbrook (Maud E. Safford).

Euphorbia commutata Engelm. Tinted Spurge.
Midland and Mountain Zones; in moist forests and flood plains, being known only along the Potomac river.

CALLITRICHACEAE.

Callitriche austini Engelm. Water Starwort.
Harford County, Edgewood (Robert K. Miller); Calvert County, Chesapeake Beach (Joseph H. Painter).

Callitriche palustris L.
Baltimore County, Gunpowder river (Robert K. Miller).

Callitriche heterophylla Pursh.
Throughout the state; in ponds and slow running streams; common.
Wicomico County, Shad Point (1181).

LIMNANTHACEAE.

Floerkea proserpinacoides Willd. False Mermaid.
Midland Zone; in flood plain forests; rare.
Baltimore County, Western Run (1395); Patapsco river, near Ellicott City (W. S. Cooper).

ANACARDIACEAE.

Rhus copallina L. Black Sumac.
Throughout the state; in dry forests and open situations; common.

Rhus hirta (L.) Sudw. Staghorn Sumac.
Throughout the state; in dry forests and thickets; frequent.

Rhus glabra L. Scarlet Sumac.
Throughout the state; in dry thickets and open situations; common.

Rhus aromatica Ait. Fragrant Sumac.
Infrequent in the Upper Midland District in dry forests and open situations.
Washington County, Hancock (693).

Rhus vernix L. Poison Sumac.
Coastal and Midland Zones; in bogs and swamps; infrequent.

Rhus radicans L. Poison Ivy.
Throughout the state; in all sorts of situations; common.

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ILICACEAE.

Ilex opaca Ait. Holly.
Common in the Coastal Zone in upland forests, rare as a shrub in the Midland Zone.
Charles County, Zekiah Swamp (1527).

Ilex glabra (L.) A. Gray. Inkberry.
Coastal Zone; in dry forests on sandy soil; locally abundant but not widely diffused.

Ilex verticillata (L.) A. Gray. Winterberry.
Throughout the state; being common in the Coastal Zone in stream swamps and frequent in sandy upland swamps, infrequent in the Midland and Mountain Zones in sandy swamps.
Garrett County, Thayerville (2055).

Ilex bronxensis Britton.
Washington County, ravine near Tonoloway Ridge (771).

Ilex laevigata (Pursh.) A. Gray. Smooth Winterberry.
Worcester County, Steves Island (Robert K. Miller).

Iliciodes mucronata (L.) Britton. Mountain Holly.
Mountain Zone; in swamps and bogs; frequent.
Garrett County, Thayerville (2057).

CELASTRACEAE.

Euonymus americanus L. Strawberry Bush.
Throughout the state; in moist forests and flood plains; common.
Talbot County, Easton (1505).

Euonymus atropurpureus Jacq. Burning Bush, Wahoo.
Midland and Mountain Zones; in moist forests and on rocky cliffs; frequent.
Washington County, Williamsport (1800).

Celastrus scandens L. Bittersweet, Waxwork.
Throughout the state; in moist forests and thickets; common.
Anne Arundel County, Brooklyn (427).

STAPHYLEACEAE.

Staphylea trifolia L. Bladder Nut.
Midland and Mountain Zones; in flood plains; infrequent.
Washington County, Hancock (734).

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ACERACEAE.

Acer saccharinum L. Silver Maple.
Rare in the Coastal Zone; common in the Midland Zone; absent from the Mountain Zone; one of the most abundant and characteristic trees in flood plains and along streams.

Acer rubrum L. Red Maple, Swamp Maple.
Throughout the state; is most common in the Coastal Zone, where it is one of the characteristics trees of stream swamps and upland swamps, and frequent in upland forests; is less frequent in the Midland Zone, and in the Mountain Zone is nearly confined to moist sandy soil.

Acer saccharum Marsh. Sugar Maple, Rock Maple.
Midland and Mountain Zones; being one of the characteristic trees of the lower slopes of the mountain ridges; infrequent in the Lower Midland District.

Acer nigrum Michx. Black Sugar Maple.
Midland and Mountain Zones; on rocky slopes and cliffs; infrequent.
Frederick County, Thurmont (1755).

Acer pennsylvanicum L. Striped Maple, Goosefoot Maple.
Mountain Zone; in moist and dry forests of mountain slopes; frequent.
Allegany County, near Cumberland (870).

Acer spicatum Lam. Mountain Maple.
Upper Midland District and Mountain Zone; on rocky slopes and cliffs; infrequent.
Garrett County, near Swanton (498).

Acer negundo L. Box Elder.
Rare in the Coastal Zone, along streams in Anne Arundel and Prince George's counties; frequent in the Midland Zone in flood plains; apparently absent from the Mountain Zone.

BALSAMINACEAE.

Impatiens biflora Walt. Spotted Touch-me-not.
Throughout the state; in moist forests, swamps, fresh marshes and other open wet situations; common.

Impatiens aurea Muhl. Pale Touch-me-not.
Midland and Mountain Zones; in flood plains and along streams; frequent.

RHAMNACEAE.

Rhamnus frangula L. Alder Buckthorn.
Baltimore County, Pikesville (B. W. Barton).

Ceanothus americanus L. New Jersey Tea.
Coastal and Midland Zones; in dry forests and thickets; common.

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VITACEAE.

Vitis labrusca L. Fox Grape.
Throughout the state; in moist and dry forests and occasionally on trees in the open; common.

Vitis aestivalis Michx. Summer Grape.
Throughout the state; in forests and open situations; common.

Vitis cordifolia Michx. Chicken Grape, Frost Grape.
Throughout the state; in forests and open situations; common.

Vitis rotundifolia Michx. Bullace Grape.
Coastal Zone; in the river swamps of Worcester County; infrequent.
Worcester County, Steves Island (664).

Parthenocissus quinquefolia (L.) Planch. Virginia Creeper.
Throughout the state; in all situations; one of the commonest climbers.

TILIACEAE.

Tilia americana L. Linden, Basswood.
Rare in the Coastal Zone in ravine slopes; infrequent in the Lower Midland District, common in the Upper Midland District and Mountain Zone in deep well-drained soils of the lower slopes of mountain ridges.

MALVACEAE.

Malva sylvestris L. High Mallow.
Midland Zone; in forests and open situations; infrequent. Introduced from Europe.

Malva rotundifolia L. Low Mallow, Cheeses.
Throughout the state; in cultivated and waste grounds; common. Introduced from Europe.

Sida spinosa L. Prickly Sida.
Throughout the state; in waste and cultivated grounds; frequent. Introduced from the southern states.

Abutilon abutilon (L.) Rusby. Velvet Leaf.
Throughout the state; in cultivated grounds and waste places; common. Introduced from India.

Kosteletzkya virginica (L.) A. Gray.
Coastal Zone; in salt and brackish marshes; common.

Hibiscus moscheutos L. Swamp Rose-Mallow.
Coastal Zone; in brackish and fresh marshes; common.
Caroline County, Dover Bridge (2068).

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Hibiscus militaris Cav. Halberd-leaved Rose-Mallow.
Montgomery County, Great Falls (Robert K. Miller).

Hibiscus trionum L. Bladder Ketmia.
Wicomico County, Salisbury (W. Ralph Jones). Introduced.

HYPERICACEAE.

Ascyrum stans Michx. St. Peter's-wort.
Coastal Zone; in dry forests, being most abundant on sandy soil.
Worcester County, Berlin (660).

Ascyrum hypericoides L. St. Andrew's Cross.
Common in the Coastal Zone in dry forests and open situations, rare in the Midland Zone in dry sandy soil.
Worcester County, Berlin (661).

Hypericum prolificum L. Shrubby St. John's-wort.
Midland Zone; in moist open situations; infrequent.
Washington County, Hancock (730).

Hypericum densiflorum Pursh. Bushy St. John's-wort.
Throughout the state; infrequent in bogs and open wet situations in the Coastal Zone and Midland Zone; common in the Mountain Zone.
Queen Anne's County, Sudlerville (1670).

Hypericum perforatum L. St. John's-wort.
Throughout the state; in fields and waste situations; common. Introduced from Europe.

Hypericum maculatum Walt. Spotted St. John's-wort.
Throughout the state; in moist open situations; frequent.
Cecil County, Leslie (421).

Hypericum mutilum L. Dwarf St. John's-wort.
Throughout the state; in fresh marshes, swamps, moist forests and open wet situations; common.

Hypericum canadense L. Canadian St. John's-wort.
Throughout the state; in fresh marshes, swamps and open wet situations; common.
Wicomico County, near Vienna (1327).

Sarothra gentianoides L. Pine Weed, Orange Grass.
Throughout the state, being common on the lighter soils of the Coastal Zone, and frequent in dry open situations in the Midland and Mountain Zones.
Allegany County, Cumberland (922).

Triadenum virginicum (L.) Raf. Marsh St. John's-wort.
Common in the Coastal Zone; infrequent in the Midland Zone in fresh marshes, swamps and open wet situations.

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Triadenum petiolatum (Walt.) Britton. Larger Marsh St. John's-wort.
Coastal Zone, Worcester, Wicomico and Charles Counties; in river swamps and stream swamps; infrequent.
Worcester County, Mattaponi Landing (1142).

ELATINACEAE.

Elatine americana (Pursh.) Arn. Water-wort, Mud Purslane.
Wicomico County, tidal flats of the Wicomico river near Salisbury (1264a).

CISTACEAE.

Helianthemum majus (L.) B. S. P. Hoary Frostweed.
Throughout the state; being most abundant on the light soils of the Coastal Zone.
Wicomico County, Tonytank Creek (1179).

Helianthemum canadense (L.) Michx. Long Branched Frostweed.
Throughout the state; in dry forests and open situations, being most abundant in the Coastal Zone.
Washington County, near Hancock (824).

Lechea minor L. Pin Weed.
Throughout the state; in dry forests and open situations; common.
Cecil County Egg Hill (395).

Lechea racemulosa Michx.
Cecil County, Hog Hills (392).

Lechea villosa Ell.
Anne Arundel County, open sandy situations near Benfield (Robert K. Miller).

Lechea leggettii Britton & Hollick.
Throughout the state; in dry situations; infrequent.
Allegany County, Cumberland (929); Wicomico County, near Vienna (1313).

Hudsonia tomentosa Nutt. Wooly Hudsonia.
Coastal Zone.

VIOLACEAE.

Viola palmata L. Early Blue Violet.
Throughout the state; in dry situations; common.

Viola obliqua Hill. Thin-leaved Wood Violet.
Coastal and Midland Zones; in moist forests; infrequent.
Talbot County, near Trappe (1516).

Viola cucullata Ait. Marsh Blue Violet.
Throughout the state; in moist forests; common.
Baltimore County, Lorely (Robert K. Miller).

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Viola sagittata Ait. Arrow-leaved Violet.
Throughout the state; in moist forests and flood plains; frequent.
Allegany County, Cumberland (George M. Perdew).

Viola ovata Nutt. Ovate-leaved Violet.
Midland Zone; in dry forests; frequent.

Viola pedata L. Bird's-foot Violet.
Throughout the state; in dry forests and open situations; common.

Viola rotundifolia Michx. Round-leaved Violet.
Mountain Zone; in moist forests; infrequent.
Garrett County, Kelso Gap (2039).

Viola blanda Willd. Sweet White Violet.
Throughout the state; in moist forests and flood plains; common.

Viola primulaefolia L. Primrose-leaved Violet.
Throughout the state; in moist forests and flood plains; common.
Wicomico County, near Vienna (1340).

Viola lanceolata L. Lance-leaved Violet.
Throughout the state; in moist forests; frequent.
Talbot County, Easton (1373).

Viola scabriuscula (T. & G.) Schwein. Smoothish Yellow Violet.
Midland Zone; in moist forests; frequent.
Washington County, Hancock (823).

Viola canadensis L. Canada Violet.
Mountain Zone; in moist forests; common.
Garrett County, Kelso Gap (531).

Viola striata Ait. Pale Violet.
Midland Zone; in flood plains; rare.
Montgomery County, Great Falls (463).

Viola labradorica Schrank. American Dog Violet.
Midland and Mountain Zones; in forests; common.
Baltimore County, Parkton (1363).

Viola tricolor L. Heart's Ease.
Midland and Mountain Zones; in forests; infrequent. Introduced.

Cubelium concolor (Forst.) Raf. Green Violet.
Midland Zone; in moist forests; infrequent.
Washington County, Hancock (722).

PASSIFLORACEAE.

Passiflora lutea L. Yellow Passion-flower.
Midland and Mountain Zones; in moist forests; rare.
Allegany County, Cumberland (Howard Shriver); Calvert County, Chesapeake Beach (Joseph H. Painter).

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CACTACEAE.

Opuntia opuntia (L.) Prickly Pear.
Apparently nearly confined to the Coastal Zone, where it is common in forests and open situations on sandy soil.
Caroline County, Federalsburg (1634).

THYMELEACEAE.

Dirca palustris L. Moose-wood, Leather-wood.
Midland and Mountain Zones; in moist forests; infrequent.
Montgomery County, Great Falls (Joseph H. Painter).

LYTHRACEAE.

Ammania koehnei Britton.
Worcester County, Greenbackville (1109).

Rotala ramosior (L.) Koehne.
Apparently confined to the Coastal Zone; in moist open situations, preferring sand.
Worcester County, Wagram (1161); St. Mary's County, Piney Point (M. A. Chrysler).

Decodon verticillatus (L.) Ell. Swamp Loosestrife, Willow Herb.
Throughout the state, being common in the Coastal Zone, and infrequent in the Midland and Mountain Zones; in swamps and marshes and about the margins of ponds.

Lythrum alatum Pursh. Loosestrife.
Montgomery County, Great Falls (Robert K. Miller).

Lythrum lineare L. Loosestrife.
Coastal Zone; in brackish marshes; common.
Talbot County, Skipton Creek (109).

Lythrum salicaria L. Purple Loosestrife.
Calvert County, fresh marshes of the Patuxent River (Robert K. Miller).

Parsonsia petiolata (L.) Rusby. Tar-weed, Wax-weed.
Throughout the state; in moist and dry open situations; common.

MELASTOMACEAE.

Rhexia mariana L. Meadow Beauty.
Coastal and Midland Zones, being common in the former, infrequent in the later; in moist sandy situations.
Worcester County, Greenbackville (1119).

Rhexia virginica L. Deer Grass.
Coastal Zone; in moist sandy situations; frequent.
Talbot County, Easton (116).

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ONAGRACEAE.

Isnardia palustris L. Marsh Purslane.
Throughout the state; in fresh marshes, swamps and open wet situations; common.

Ludwigia sphaerocarpa Ell. Globe-fruited Ludwigia.
Coastal and Midland Zones; frequent in the Coastal and rare in the Midland; in fresh marshes and swamps.
Talbot County, Easton (126).

Ludwigia linearis Walt. Linear-leaved Ludwigia.
Coastal Zone; in wet sandy situations; infrequent.
Worcester County, near Berlin (637).

Ludwigia alternifolia L. Seed Box.
Throughout the state; in fresh marshes, swamps and open wet situations; common.

Jussiaea decurrens (Walt.) DC. Upright Primrose-willow.
Coastal Zone; in fresh marshes; rare.
Charles County, Marshall Hall (M. A. Chrysler); Caroline County, near Tuckahoe Bridge (1650).

Chamaenerion angustifolium (L.) Scop. Fire Weed.
Throughout the state; in dry forests, clearings and open situations; common.
Garrett County, Swallow Falls (543).

Epilobium coloratum Muhl. Purple-leaved Willow-herb.
Throughout the state; in fresh marshes and open wet situations; common.
Cecil County, Leslie (363).

Epilobium adenocaulon Haussk. Northern Willow-herb.
Throughout the state; in fresh marshes, swamps and open wet situations; frequent.
Allegany County, Braddock Run (918).

Onagra biennis (L.) Scop. Evening Primrose.
Throughout the state; in cultivated and waste grounds and dry situations generally; common.

Oenothera humifusa Nutt. Seaside Evening Primrose.
Coastal Zone; on the strand of the ocean front; frequent.
Worcester County, Ocean City (1251).

Oenothera laciniata Hill.
Caroline County, near Greensborough (1640).*

*This number was determined by the United States National Herbarium as *Raimannia humifusa* (Nutt.) Rose.

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Kneiffia longipedicillata Small. Sundrops.
Throughout the state; in dry forests and open situations; frequent.
Cecil County, Conowingo (406).

Kneiffia pumila (L.) Spach. Small Sundrops.
Throughout the state; in dry forests and open situations; common.
Garrett County, Oakland (541).

Kneiffia fruticosa (L.) Raimann. Common Sundrops.
Throughout the state; in dry situations; frequent.
Garrett County, Big Savage Mountain (850).

Gaura biennis L. Gaura.
Throughout the state; in waste grounds; locally common.
Cecil County, Elkton (377).

Circaea lutetiana L. Enchanter's Nightshade.
Throughout the state; in moist forests and flood plains; common.

Circaea alpina L. Smaller Enchanter's Nightshade.
Rare in the Midland Zone, common in the Mountain Zone in moist forests.
Garrett County, Swallow Falls (549).

HALORAGIDACEAE.

Proserpinaca palustris L. Mermaid Weed.
Coastal Zone; in marshes, swamps and wet situations with sandy soil, also in shallow ponds; frequent.
Caroline County, Dover Bridge (2069).

Myriophyllum verticillatum L. Whorled Water Milfoil.
Coastal and Midland Zones; in quiet streams and ponds; frequent.
Wicomico County, Salisbury (1208).

Myriophyllum humile (Raf.) Morong. Low Water Milfoil.
Throughout the state; in ponds as an aquatic, or on mud about ponds and along streams; common.

Myriophyllum pinnatum (Walt.) B. S. P. Pinnate Water Milfoil.
Coastal Zone; in ponds and streams; infrequent.
Worcester County, Boxiron (1061).

ARALIACEAE.

Aralia spinosa L. Hercules' Club.
Coastal Zone; in upland swamps and moist forests, being most abundant on the Talbot formation on the Eastern Shore.

Aralia racemosa L. Spikenard.
Rare in the Coastal Zone; frequent in the Midland and Mountain Zones; in moist forests.
Washington County, near Rohrersville (1791).

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Aralia nudicaulis L. Wild Sarsaparilla.
Rare in the Coastal Zone; common in the Midland and Mountain Zones; in moist and dry forests.
Baltimore County, Western Run (1402).

Panax quinquefolium L. Ginseng.
Rare in the Lower Midland District, infrequent in the Upper Midland District and Mountain Zone; in moist forests of mountain slopes.
Washington County, Round Top (749).

Panax trifolium L. Dwarf Ginseng.
Midland and Mountain Zones; in moist forests; infrequent.
Baltimore County, Western Run (1391).

UMBELLIFERAE.

Daucus carota L. Wild Carrot, Queen Anne's Lace.
Throughout the state; in waste grounds and fields; common. Introduced from Europe.

Angelica villosa (Walt.) B. S. P. Pubescent Angelica.
Infrequent in the Coastal Zone; common in the Midland and Mountain Zones; in dry open forests, being most frequent in the cut-over forests of the mountain ridges.
Cecil County, Hog Hills (389).

Oxypolis rigidus (L.) Britton. Cowbane.
Throughout the state, being common in the fresh marshes and swamps of the Coastal Zone, and frequent in swamps and open wet situations in the Midland.
Allegany County, near Cumberland (976).

Heracleum lanatum Michx. Cow Parsnip.
Midland Zone; in open situations in moist flood plains; frequent.
Harford County, Glenville (1568).

Pastinaca sativa L. Wild Parsnip.
Throughout the state; in cultivated and waste grounds; common. Introduced from Europe.

Thaspium barbinode (Michx.) Nutt. Meadow Parsnip.
Throughout the state; in open moist situations; frequent.

Thaspium trifoliatum (L.) Britt. Purple Meadow-Parsnip.
Upper Midland District.

Lilaeopsis lineata (Michx.) Greene. Lilaeopsis.
Coastal Zone; being confined to shallow water and tidal flats in the brackish and fresh water of the upper Chesapeake Bay and its tributaries; frequent.
Kent County, near Chestertown (1708).

Eryngium aquaticum L. Rattlesnake-master.
Montgomery County, Cabin John (Robert K. Miller).

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Eryngium virginianum Lam. Eryngio.
Coastal Zone; common and characteristic in the brackish and fresh marshes of the Chesapeake and its tributaries, and of the coastal inlets; not growing elsewhere.
Worcester County, Herring Creek (643).

Sanicula marylandica L. Sanicle.
Midland and Mountain Zones; in moist forests; frequent.
Washington County, Round Top (705).

Sanicula gregaria Bicknell. Clustered Snakeroot.
Throughout the state; in moist forests and flood plains; frequent.

Foeniculum foeniculum (L.) Karst. Fennel.
Throughout the state; in waste and cultivated grounds; frequent. Introduced from Europe.

Pimpinella integerrima (L.) A. Gray. Yellow Pimpernel.
Throughout the state, being infrequent in the Coastal Zone and common in the Midland and Mountain Zones; in moist forests.
Garrett County, Mountain Lake Park (525).

Bupleurum rotundifolium L. Hare's Ear.
Allegany County, Cumberland (George M. Perdew).

Chaerophyllum procumbens (L.) Crantz. Chervil.
Midland Zone; in moist forests and flood plains; infrequent.
Montgomery County, Great Falls (1438).

Washingtonia claytoni (Michx.) Britton. Wooly Sweet Cicely.
Throughout the state; in moist forests and flood plains; frequent.

Washingtonia longistylis (Torr.) Britton. Smooth Sweet Cicely.
Throughout the state; in moist forests; common.
Kent County, near Chestertown (1709).

Sium cicutaefolium Gmel. Hemlock Water Parsnip.
Common in the Coastal Zone in fresh marshes and infrequent in swamps; rare in the Midland Zone.

Zizia aurea (L.) Koch. Golden Meadow-Parsnip.
Garrett County, Oakland (Joseph E. Harned).

Zizia cordata (Walt.) DC. Heart-leaved Alexanders.
Throughout the state; infrequent in the Coastal Zone; common in the Midland and Mountain Zones.

Cicuta maculata L. Water Hemlock.
Throughout the state; in marshes, swamps and open wet situations; common.

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Cicuta bulbifera L. Bulb-bearing Water Hemlock.
Midland Zone; frequent along the Potomac River in open wet situations.
Montgomery County, Great Falls (Robert K. Miller).

Deringa canadensis (L.) Kuntze. Honewort.
Throughout the state; in moist forests and flood plains; frequent.
Garrett County, Swanton (508).

Ptilimnium capillaceum (Michx.) Hollick. Mock Bishop-weed.
Throughout the state; common in fresh marshes in the Coastal Zone, frequent in open wet situations in all parts of the state.

Aegopodium podagraria L. Goutweed.
Baltimore County, Towson (Robert K. Miller).

Hydrocotyle umbellata L. Marsh Pennywort.
Throughout the state; in all moist situations; common.

Hydrocotyle canbyi C. & R.
Worcester County, Ocean City, in fresh marshes (Robert K. Miller).

Hydrocotyle verticillata Thumb. Whorled Marsh Pennywort.
Coastal Zone; in marshes and other wet situations; infrequent.

Hydrocotyle americana L. American Marsh Pennywort.
Rare in the Coastal Zone; common in the Midland and Mountain Zones; in moist forests.
Washington County, near Rohrersville (1785).

Hydrocotyle ranunculoides L. *f.* Floating Marsh Pennywort.
Coastal Zone; in pools and streams; frequent.
Anne Arundel County, near Leon (1551).

Centella asiatica (L.) Urban.
Coastal Zone; in open moist sandy situations; rare.
Worcester County, Ocean City (1254a).

Erigenia bulbosa (Michx.) Nutt. Harbinger of Spring.
Montgomery County, near Great Falls (Frederick H. Blodgett).

CORNACEAE.

Cornus canadensis L. Dwarf Cornel, Bunch-Berry.
Mountain Zone; about the margins of bogs; infrequent.
Garrett County, Thayerville (2050).

Cornus florida L. Dogwood.
Coastal and Midland Zones, absent from the Mountain Zone; in moist and dry upland forests, being one of the commonest small trees in all forests.

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Cornus amomum Mill. Kinnikinnik.
Coastal and Midland Zones; in swamps and along streams; common.
Worcester County, Snow Hill (1080).

Cornus candidissima Marsh. Panicled Dogwood.
Infrequent in the Midland Zone, common in the Mountain Zone; in moist and dry forests.
Garrett County, Mountain Lake Park (539).

Cornus alternifolia L. f. Alternate-leaved Dogwood.
Rare in the Midland Zone, common in the Mountain Zone; in moist forests.
Garrett County, Crellin (1993).

Nyssa sylvatica Marsh. Black Gum, Sour Gum, Tupelo.
Throughout the state; in the Coastal Zone it is one of the commonest trees in swamps, both along streams and in the upland, and is an important constituent of all types of forest; in the Midland Zone it is common in flood plains, but infrequent in the upland; in the Mountain Zone it is infrequent, in wet sandy soil and glade and swamp forest.

Nyssa biflora Walt. Southern Tupelo.
Coastal Zone; confined to the river swamps of the Pocomoke, where it is frequent.
Worcester County, Snow Hill (1078); Somerset County, near Pocomoke City (1149).

CLETHRACEAE.

Clethra alnifolia L. Sweet Pepper-bush.
Coastal Zone; in swamps, moist forests and open wet situations; common.
Talbot County, Easton (55).

PYROLACEAE.

Pyrola rotundifolia L. Round-leaved Wintergreen.
Throughout the state, being most common in dry forests of the Midland Zone.

Pyrola chlorantha Sw. Greenish-flowered Wintergreen.
Prince George's County, Lanham (Joseph H. Painter).

Pyrola elliptica Nutt. Shin-leaf.
Throughout the state; in dry forests; common.
Garrett County, Oakland (519).

Pyrola secunda L. Serrated Wintergreen.
Charles County, Cox; Prince George's County, Bowie (M. A. Chrysler).

Chimaphila maculata (L.) Pursh. Spotted Wintergreen.
Throughout the state; in dry forests; common.

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Chimaphila umbellata (L.) Nutt. Pipsissewa.
Throughout the state; in dry forests; common.

MONOTROPACEAE.

Monotropsis odorata Ell. Sweet Pine-sap, Schweinitzia.
Anne Arundel County, near Annapolis (Lawrence G. Painter); Baltimore County, near Towson (Forrest Shreve).

Monotropa uniflora L. Indian Pipe.
Throughout the state; in moist and dry forests; common.

Hypopitys hypopitys (L.) Small. Pine-sap.
Throughout the state; in moist forests, particularly of the Midland Zone; frequent.

ERICACEAE.

Azalea nudiflora L. Wild Azalea, Wild Honeysuckle.
Throughout the state; in moist forests, being most frequent in the Coastal Zone and Lower Midland District.
Montgomery County, Great Falls (1379).

Azalea lutea L. Flame Azalea.
Mountain Zone; in dry forests; rare.

Azalea viscosa L. White Azalea.
Throughout the state; in swamps and moist forests; frequent.
Dorchester County, Castle Haven (1595).

Azalea viscosa var. **glauca** Michx.
Queen Anne's County, near Schenk Corners (1685); Montgomery County, near Rockville (Joseph H. Painter); Baltimore County, near Towson (Robert K. Miller).

Rhododendron maximum L.
Upper Midland District and Mountain Zone, and on Egg Hill, Cecil County; common on rocky slopes, along the borders of mountain streams and in the swamps of the Mountain Zone.
Garrett County, near Finzel (962).

Menziesia pilosa (Michx.) Pers. Menziesia.
Mountain Zone; on rocky slopes; infrequent.
Garrett County, Swanton (492).

Chamaedaphne calyculata (L.) Moench. Leather-leaf.
Coastal Zone.

Kalmia angustifolia L. Sheep Laurel, Wicky.
Western Shore District of the Midland Zone; in dry thickets; infrequent.
Anne Arundel County, Glenburnie (268).

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Kalmia latifolia L. Mountain Laurel, Calico-bush.
Throughout the state; rare in the southern Eastern Shore, common throughout the remainder of the state in dry forests and clearings, preferring gravel or thin rocky soil.
Talbot County, near Easton (1524).

Leucothoë racemosa (L.) A. Gray. Swamp Leucothoë.
Coastal Zone; in swamps and moist thickets; common.
Anne Arundel County, Odenton (1475).

Pieris mariana (L.) Benth. & Hook. Stagger-bush.
Coastal Zone; in swamps and moist forests, preferring sandy soil; common.
Talbot County, Easton (181).

Xolisma ligustrina (L.) Britton. Privet Andromeda.
Throughout the state; in swamps, moist forests and open situations; common.
Prince George's County, near Halls Bridge (1543).

Epigaea repens L. Trailing Arbutus.
Throughout the state; in dry forests, preferring rocky slopes or sandy soil; common.

Gaultheria procumbens L. Creeping Wintergreen.
Throughout the state; common in portions of Worcester, Wicomico and Anne Arundel Counties and in the Mountain Zone, infrequent elsewhere.
Washington County, Tonoloway Ridge (764).

VACCINIACEAE.

Gaylussacia frondosa (L.) T. & G. Tangleberry.
Throughout the state in moist forests and thickets; common.

Gaylussacia resinosa (Ait.) T. & G. High-bush Huckleberry.
Throughout the state; in dry forests; common.

Gaylussacia resinosa var. **glaucocarpa** Robinson.
Washington County, Tonoloway Ridge (763).

Gaylussacia dumosa (Andr.) T. & G. Bush Huckleberry.
Mountain Zone.

Vaccinium corymbosum L. High-bush Blueberry.
Throughout the state; most common in the Coastal Zone, frequent in the Midland and Mountain Zones.
Washington County, near Smoketown (1794).

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Vaccinium pennsylvanicum Lam. Dwarf Blueberry.
Throughout the state; in dry forests; frequent.
Garrett County, Big Savage Mountain (841).

Vaccinium vacillans Kalm. Blue Huckleberry.
Midland and Mountain Zones, being most abundant in the latter.
Garrett County, Swanton (479).

Vaccinium stamineum L. Deerberry.
Throughout the state; in dry forests and thickets; common.
Charles County, Cox (1538).

Oxycoccus macrocarpus (Ait.) Pers. Cranberry.
Escaped from cultivation near Salisbury; indigenous in the bogs of the Mountain Zone.
Garrett County, Thayerville (2062).

PRIMULACEAE.

Samolus floribundus H. B. K. Water Pimpernel.
Coastal Zone; in brackish and fresh marshes; common.
Worcester County, Greenbackville (1108).

Lysimachia vulgaris L. Golden Loosestrife.
Harford County, Bush River Neck (M. A. Chrysler). Introduced.

Lysimachia quadrifolia L. Crosswort.
Throughout the state; in moist and dry forests; common.

Lysimachia terrestris (L.) B. S. P. Bulb-bearing Loosestrife.
Frequent in the Coastal Zone, infrequent in the Midland Zone; in fresh marshes and about the margins of ponds.
Wicomico County, Shad Point (1199).

Lysimachia nummularia L. Moneywort.
Throughout the state; in ditches and about the margins of ponds; infrequent. Introduced from Europe.
Baltimore (W. Ralph Jones).

Steironema ciliatum (L.) Raf. Fringed Loosestrife.
Infrequent in the Coastal Zone, common in the Midland and Mountain Zones; in moist forests and meadows.
Allegany County, near Cumberland (992).

Steironema lanceolatum (Walt.) A. Gray. Lance-leaved Loosestrife.
Anne Arundel County, Annapolis (M. A. Chrysler).

Trientalis americana Pursh. Star-flower.
Garrett County, near Finzel (George M. Perdew).

Anagallis arvensis L. Scarlet Pimpernel.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

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Dodecatheon meadia L. Shooting Star.
Upper Midland District and Mountain Zone; in moist forests; infrequent.

PLUMBAGINACEAE.

Limonium carolinianum (Walt.) Britton. Sea Lavender.
Coastal Zone; in salt and brackish marshes; common.

EBENACEAE.

Diospyros virginiana L. Persimmon.
Throughout the Coastal and Midland Zones, absent from the Mountain Zone. Is abundant in the upland forests of the Coastal Zone, and frequent in the Midland Zone, but more often as an isolated tree in open situations.

SYMPLOCACEAE.

Symplocos tinctoria (L.) L'Her. Sweet-Leaf.
Worcester County (H. H. Rusby).

OLEACEAE.

Fraxinus americana L. White Ash.
Throughout the state; in swamps and ravines and along streams; common.

Fraxinus lanceolata Borck. Green Ash.
Coastal and Midland Zones; common in the river and stream swamps of the Coastal Zone, frequent in flood plains and along streams in the Midland Zone.
Somerset County, near Mattaponi Landing (1147).

Fraxinus pennsylvanica Marsh. Red Ash.
Throughout the state; in flood plains and along streams; infrequent.

Fraxinus nigra Marsh. Black Ash.
Throughout the state; in swamps and flood plains; infrequent.

Chionanthus virginica L. Fringe-tree.
Coastal and Midland Zones; being most abundant in moist sandy flood plains and sandy-loam upland swamps in the Coastal Zone; is infrequent in moist sandy soil in the Midland Zone; has been observed in apparently dry situations on the gravel hills of Cecil County and on rocky slopes in Montgomery County.

LOGANIACEAE.

Polypremum procumbens L.
Confined to the southern counties of the Eastern Shore; in open fields and waste grounds; infrequent.
Worcester County, Boxiron (1069).

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GENTIANACEAE.

Erythraea pulchella (Sw.) Fries. Branching Centaury.
Throughout the state; in moist open situations; infrequent.
Worcester County, Greenbackville (1111).

Sabbatia angularis (L.) Pursh. Rose Pink.
Coastal and Midland Zones; in open situations; infrequent.

Sabbatia stellaris Pursh. Marsh Pink.
Coastal Zone; in salt and brackish marshes; common.
Worcester County, Greenbackville (1114).

Sabbatia dodecandra (L.) B. S. P. Large Marsh Pink.
Coastal Zone; in brackish and fresh marshes; common.
Worcester County, Boxiron (1060).

Gentiana crinita Froel. Fringed Gentian.
Throughout the state; in fields and open meadows; infrequent.

Gentiana andrewsii Griseb. Closed Gentian.
Throughout the state; in dry forests and open situations; common.

Gentiana linearis Froel. Narrow-leaved Gentian.
Mountain Zone; in bogs and moist sandy forests; common.
Garrett County, Thayerville (2060).

Gentiana villosa L. Striped Gentian.
Midland Zone; in moist forests; infrequent.
Baltimore County, Cockeysville (Robert K. Miller).

Obolaria virginica L. Pennywort.
Midland Zone; in rich forests; infrequent.
Baltimore County, Catonsville (Robert K. Miller).

Bartonia virginica (L.) B. S. P.
Frequent in moist sandy forests in the Coastal Zone, rare in the Midland Zone.
Worcester County, Snow Hill (1033).

MENYANTHACEAE.

Limnanthemum aquaticum (Walt.) Britton. Floating Heart.
Coastal Zone; in ponds and slow streams; infrequent.
Wicomico County, Salisbury (1224).

APOCYNACEAE.

Apocynum androsaemifolium L. Dogbane.
Throughout the state; in dry forests and open situations; common.

Apocynum cannibinum L. Indian Hemp.
Throughout the state; in open dry situations; infrequent.
Kent County, Lloyds Creek (1705).

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ASCLEPIADACEAE.

Asclepias tuberosa L. Butterfly Weed.
Throughout the state; in open dry situations, preferring sandy soil; common.

Asclepias decumbens L. Decumbent Butterfly Weed.
Baltimore County, Loch Raven (Robert K. Miller).

Asclepias lanceolata Walt. Few-flowered Milkweed.
Coastal Zone; in moist sandy open situations; rare.
Worcester County, Ocean City (1248).

Asclepias rubra L. Red Milkweed.
Throughout the state; in open moist situations; infrequent.
Carroll County, near Westminster (1719).

Asclepias purpurascens L. Purple Milkweed.
Throughout the state; in forests and open situations; infrequent.
Talbot County, Easton (1712).

Asclepias incarnata L. Swamp Milkweed.
Throughout the state; in open wet situations; common.

Asclepias pulchra Ehrh. Hairy Milkweed.
Throughout the state, being most abundant in the fresh marshes of the Coastal Zone, frequent in open wet situations throughout the state.

Asclepias obtusifolia Michx. Blunt-leaved Milkweed.
Common in the Coastal Zone, frequent in the Midland Zone; in dry open situations, preferring sandy soil.
Caroline County, Federalsburg (1627).

Asclepias exaltata (L.) Muhl. Tall Milkweed.
Midland and Mountain Zones; in moist forests and open situations; infrequent.
Garrett County, Deer Park (1956).

Asclepias variegata L. White Milkweed.
Throughout the state; in moist and dry forests and open situations; frequent.
Caroline County, Greensborough (1641).

Asclepias quadrifolia Jacq. Four-leaved Milkweed.
Throughout the state; in moist forests; common.
Harford County, Deer Creek (1575).

Asclepias syriaca L. (*cornuti* Dec.) Common Milkweed.
Throughout the state; in cultivated and waste grounds; common.

Asclepias verticillata L. Whorled Milkweed.
Throughout the state; in open dry situations; infrequent.
Montgomery County, Laytonsville (1729).

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Acerates viridiflora (Raf.) Eaton. Green Milkweed.
Washington County, Hancock (688).

Vincetoxicum hirsutum (Michx.) Britton.
Charles County, Port Tobacco (M. A. Chrysler).

Vincetoxicum shortii (A. Gray) Britton.
Allegany County, Cumberland (George M. Perdew).

CONVOLVULACEAE.

Quamoclit coccinea (L.) Moench. Red Morning-glory.
Throughout the state; in thickets and open situations; frequent.

Ipomoea lacunosa L. White Morning-glory.
Throughout the state; in dry fields and open situations; common.

Ipomoea purpurea (L.) Roth. Common Morning-glory.
Throughout the state; in cultivated grounds; common. Introduced from South America.

Ipomoea hederacea Jacq. Ivy-leaved Morning-glory.
Throughout the state; in fields and waste situations; common. Introduced from South America.

Convolvulus arvensis L. Bindweed.
Throughout the state; in cultivated grounds and waste places; common. Introduced from Europe.

CUSCUTACEAE.

Cuscuta epithymum Murr.
Midland Zone; parasitic on clover.
Baltimore County, near Towson (Robert K. Miller).

Cuscuta arvensis Beyrich. Dodder.
Throughout the state; parasitic on various flowering plants.
Cecil County, Elkton (381).

Cuscuta gronovii Willd.
Throughout the state; parasitic on flowering plants.
Allegany County, Cumberland (971).

Cuscuta compacta Juss.
Prince George's County, Hyattsville (Joseph H. Painter).

Cuscuta polygonorum Engelm. Smartweed Dodder.
Coastal Zone.

POLEMONIACEAE.

Phlox paniculata L. Garden Phlox.
Midland Zone; in waste situations; a frequent escape from gardens.

Phlox maculata L. Wild Sweet-William.
Baltimore County, near Towson (Robert K. Miller).

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Phlox ovata L. Mountain Phlox.
Allegany County, near Cumberland (George M. Perdew).

Phlox divaricata L. Wild Blue Phlox.
Montgomery County, Great Falls (Robert K. Miller).

Phlox subulata L. Moss Pink.
Midland and Mountain Zones; on open banks and rock outcrops; frequent.
Montgomery County, Great Falls (458).

Polemonium van bruntiae Britton. Jacob's Ladder.
Rare in the Coastal Zone, frequent in the Midland Zone in moist forests.
Baltimore County, Western Run (1400).

Polemonium reptans L. Greek Valerian.
Midland and Mountain Zones; in moist forests; infrequent.
Allegany County, Cumberland (George M. Perdew).

HYDROPHYLLACEAE.

Hydrophyllum virginicum L. Water-leaf.
Midland and Mountain Zones; in moist forests and flood plains; frequent.
Garrett County, Swanton (497).

Macrocalyx nyctelea (L.) Kuntze.
Midland Zone; in moist forests and flood plains; rare.
Montgomery County, Great Falls (1464); Allegany County, Cumberland (George M. Perdew).

Phacelia dubia (L.) Small. Phacelia.
Throughout the state; in moist and dry forests; being infrequent in the Coastal Zone, frequent in the Midland and Mountain Zones.
Montgomery County, Great Falls (1422).

Phacelia covillei S. Wats.
Montgomery County, near Cabin John (Robert K. Miller).

Phacelia purshii Buckl.
Montgomery County, near Great Falls (1386).

BORAGINACEAE.

Heliotropium europaeum L. European Heliotrope.
Baltimore County, Canton, on ballast (Robert K. Miller).

Cynoglossum officinale L. Hound's Tongue.
Throughout the state; in dry forests and waste situations; common.

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Cynoglossum virginicum L. Wild Comfrey.
Throughout the state; in waste situations; infrequent in the Coastal Zone, common in the Midland and Mountain Zones.
Washington County, Round Top (719).

Lappula virginiana (L.) Greene. Stickseed.
Throughout the state; in cultivated and waste grounds; infrequent in the Coastal Zone, common in the Midland and Mountain Zones.

Mertensia virginica (L.) DC. Virginia Cowslip.
Midland and Mountain Zones; in moist forests, being most abundant in the flood plains of smaller streams; infrequent.
Baltimore County, Western Run (1398).

Myosotis laxa Lehm. Forget-me-not.
Throughout the state; in wet shaded or open situations; frequent.
Anne Arundel County, Leon (1554).

Myosotis virginica (L.) B. S. P. Spring Scorpion-Grass.
Midland Zone; in dry soil; frequent.

Lithospermum arvense L. Corn Gromwell.
Throughout the state; in cultivated grounds and waste places; common.

Lithospermum canescens (Michx.) Lehm. Hoary Puccoon.
Baltimore, Arlington (Robert K. Miller).

Symphytum officinale L. Comfrey.
Midland Zone; in waste situations; infrequent. Introduced from Europe.
Baltimore County, near Towson (Robert K. Miller).

Echium vulgare L. Viper's Bugloss, Blue-weed.
Throughout the state; in fields and waste places, preferring thin soil. Introduced from Europe.

VERBENACEAE.

Verbena officinalis L. European Vervain.
Baltimore County, Canton (Robert K. Miller).

Verbena urticifolia L. White Vervain.
Throughout the state; in cultivated grounds and waste places; common.

Verbena hastata L. Blue Vervain.
Throughout the state; in waste situations; common.

Verbena angustifolia Michx. Narrow-leaved Vervain.
Throughout the state; in dry fields and waste situations; common, particularly in the Coastal Zone.
Dorchester County, near Cambridge (1582).

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Lippia lanceolata Michx. Fog-fruit.
Throughout the state; abundant in the Coastal Zone in fresh marshes, and in the Midland Zone in the low flood plains of the larger streams.
Washington County, Hancock (695).

LABIATAE.

Ajuga reptans L. Bugle.
Baltimore County, introduced (Dr. B. W. Barton).

Teucrium canadense L. Germander.
Throughout the state; in dry forests and fields; common.
Washington County, Round Top (755).

Isanthus brachiatus (L.) B. S. P. False Pennyroyal.
Washington County, Antietam River (Frederick H. Blodgett).

Trichostema dichotomum L. Blue-curls.
Throughout the state; in dry fields and open situations; common.

Scutellaria lateriflora L. Mad-dog Skullcap.
Throughout the state; in moist forests and open situations; frequent.

Scutellaria incana Muhl. Downy Skullcap.
Found just outside the state at Takoma Park, D. C. (Joseph H. Painter).

Scutellaria cordifolia Muhl. Heart-leaved Skullcap.
Throughout the state; in moist forests; rare in the Coastal Zone, frequent in the Midland Zone.

Scutellaria pilosa Michx. Hairy Skullcap.
Midland Zone; in dry forests; infrequent.
Washington County, Round Top (704).

Scutellaria integrifolia L. Hyssop Skullcap.
Throughout the state; in dry open situations and forests; particularly abundant in the Coastal Zone.

Scutellaria parvula Michx. Small Skullcap.
Prince George's County, Upper Marlborough (Joseph H. Painter).

Marrubium vulgare L. White Horehound.
Washington County, Antietam River (M. A. Chrysler).

Agastache nepetoides (L.) Kuntze. Giant Hyssop.
Throughout the state; in waste places and roadsides; frequent.
Cecil County, Elkton (373).

Agastache scrophularaefolia (Willd.) Kuntze. Giant Hyssop.
Howard County, near Mt. Airy (Frederick H. Blodgett).

Nepeta cataria L. Catnip.
Throughout the state; in waste places; infrequent. Introduced from Europe.

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Glechoma hederacea L. Gill-over-the-ground.
Throughout the state; in moist cultivated grounds and waste places; common.

Prunella vulgaris L. Heal-all.
Throughout the state; in cultivated grounds, waste places and forests; common. Introduced from Europe.

Physostegia virginiana (L.) Benth. Lion's Heart.
Midland Zone; in moist open situations; infrequent.
Washington County, Hancock (747).

Leonurus cardiaca L. Motherwort.
Throughout the state; in waste places; locally abundant.

Lamium amplexicaule L. Henbit.
Throughout the state; in waste situations; frequent. Introduced from Europe.

Lamium maculatum L. Spotted Dead-nettle.
Baltimore County, Glyndon (B. W. Barton).

Stachys aspera Michx. Rough Hedge Nettle.
Prince George's County, Laurel (M. A. Chrysler).

Stachys cordata Riddell. Light Green Hedge Nettle.
Allegany County, near Cumberland (974).

Stachys ambigua (A. Gray) Britton. Dense flowered Hedge Nettle.
Wicomico County, near Vienna (1304).*

Salvia lyrata L. Lyre-leaved Sage.
Rare in the Coastal Zone, frequent in the Midland and Mountain Zones; in moist forests.
Montgomery County, Great Falls (1424).

Monarda didyma L. Oswego Tea.
Mountain Zone; in moist forests about springs and along streams; infrequent.
Garrett County, Kelso Gap (2037).

Monarda clinopodia L. Basil Balm.
Baltimore County, Ashland (Robert K. Miller).

Monarda fistulosa L. Wild Bergamot.
Throughout the state; in open forests and waste situations; frequent.

Monarda punctata L. Horse Mint.
Throughout the state; being frequent in the Coastal Zone; frequent in the Midland and Mountain Zones in moist and dry forests.
Montgomery County, Seneca Creek (1739).

*This number was determined by the United States National Herbarium as *Stachys palustris* L.

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Hedeoma pulegioides (L.) Pers. Pennyroyal.
Throughout the state; in dry fields and forests; common.

Melissa officinalis L. Bee Balm.
Washington County, North Mountain (806).

Clinopodium vulgare L. Wild Basil.
Midland Zone; in forests and open situations; common.

Clinopodium calamintha (L.) Kuntze. Calamint, Basil Thyme.
Throughout the state; in old yards and waste situations; frequent. Introduced from Europe.

Clinopodium nepeta (L.) Kuntze. Field Balm.
Coastal Zone.

Koellia flexuosa (Walt.) MacM. Narrow-leaved Mountain Mint.
Throughout the state; in open dry situations and dry forests; common.
Washington County, Round Top (757).

Koellia virginiana (L.) MacM. Virginia Mountain Mint.
Baltimore County, near Towson (Robert K. Miller).

Koellia aristata (Michx.) Kuntze. Awned Mountain Mint.
Coastal Zone; in dry forests and open situations; infrequent.
Worcester County, near Wagram (1157).

Koellia incana (L.) Kuntze. Hoary Mountain Mint.
Throughout the state; in dry open situations; common.
Washington County, Sideling Hill (799).

Koellia mutica (Michx.) Britton. Short-toothed Mountain Mint.
Coastal Zone; in open dry situations; infrequent.
Kent County, near Fairlee (1702).

Cunila origanoides (L.) Britton. Dittany, Stone Mint.
Throughout the state; in dry forests; common.

Lycopus virginicus L. Bugle Weed.
Throughout the state; in fresh marshes, swamps and other wet situations; common.

Lycopus rubellus Moench. Stalked Water-Horehound.
Throughout the state; in open wet situations; common.

Lycopus americanus Muhl. Cut-leaved Water-Horehound.
Throughout the state; in open wet situations; infrequent.
Allegany County, near Cumberland (937).

Mentha spicata L. Spearmint.
Throughout the state; in moist fields and open situations; common. Introduced from Europe.

Mentha piperita L. Peppermint.
Throughout the state; in moist waste situations; frequent. Introduced from Europe.

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Mentha rotundifolia (L.) Huds. Round-leaved Mint.
Prince George's County, Beltsville (W. Ralph Jones).

Mentha aquatica L. Water Mint.
Coastal Zone; in wet open situations; locally abundant. Introduced from Europe.

Mentha sativa L. Marsh Whorled Mint.
Prince George's County, Nottingham (Robert K. Miller).

Collinsonia canadensis L. Citronella.
Throughout the state; in moist forests; frequent.

Perilla frutescens (L.) Britton. Perilla.
Calvert County, Parkers Creek (M. A. Chrysler).

SOLANACEAE.

Physalodes physalodes (L.) Britton. Apple-of-Peru.
Throughout the state; in waste places; infrequent. Introduced from South America.

Physalis pruinosa L. Tall Hairy Ground-Cherry.
Baltimore County, Towson (Robert K. Miller).

Physalis virginiana Mill. Virginia Ground-Cherry.
Baltimore County, near Cockeysville (Robert K. Miller).

Physalis heterophylla Nees. Ground Cherry.
Throughout the state; in dry open situations; frequent.
Caroline County, Federalsburg (1624).

Solanum nigrum L. Black Nightshade.
Throughout the state; in cultivated grounds and waste places; common.

Solanum carolinense L. Horse Nettle.
Throughout the state; in waste situations; common.

Solanum dulcamara L. Nightshade.
Throughout the state; in moist waste situations; infrequent. Introduced from Europe.

Lycium vulgare (Ait. f.) Dunal. Matrimony Vine.
Midland Zone; in waste situations; infrequent. Introduced from Europe.
Baltimore County, near Towson (Robert K. Miller).

Datura stramonium L. Jimson Weed, Jamestown Weed.
Throughout the state; in waste situations and cultivated grounds; common. Introduced from Europe.

Datura tatula L. Purple Jimson Weed.
Baltimore, Forest Park (W. Ralph Jones).

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SCROPHULARIACEAE.

Verbascum thapsus L. Mullein.
Throughout the state; in fields and waste places; common.

Verbascum blattaria L. Moth Mullein.
Throughout the state; in cultivated grounds; common.

Elatinoides spuria (L.) Wettst. Round-leaved Toad-flax.
Calvert County, Chesapeake Beach (Joseph H. Painter).

Elatinoides elatine (L.) Wettst. Toad-flax.
Coastal and Midland Zones; in dry fields; infrequent. Introduced.

Linaria linaria (L.) Karst. Butter-and-eggs.
Throughout the state; in cultivated grounds; common.

Linaria canadensis (L.) Dumort. Blue Toad-flax.
Throughout the state; in dry fields and forests; common, particularly on the light soils of the Coastal Zone.

Scrophularia marylandica L. Figwort.
Throughout the state; in moist forests and open situations; frequent.

Chelone glabra L. Turtle Head.
Throughout the state; in swamps, flood plains and open wet situations.

Pentstemon digitalis (Sweet) Nutt. Beard-tongue.
Midland Zone; in fields and along roadsides; infrequent.

Pentstemon pentstemon (L.) Britton. Smooth Beard Tongue.
Midland Zone; in forests and open situations; frequent.

Paulownia tomentosa (Thunb.) Baill. Paulownia.
Coastal and Midland Zones; sparingly escaped from cultivation. Introduced from Asia.

Mimulus ringens L. Monkey-flower.
Throughout the state; in fresh marshes, swamps and open wet situations; common.

Mimulus alatus Soland.
Throughout the state; in swamps and open wet situations; common.

Gratiola virginiana L. Clammy Hedge-hyssop.
Throughout the state; in swamps, flood plains and open wet situations; common.
Charles County, Zekiah Swamp (1532).

Gratiola aurea Muhl. Goldenpert.
Throughout the state; being common in open wet situations in the Coastal Zone, infrequent in the Midland and Mountain Zones.
Wicomico County, Salisbury (1272).

Gratiola sphaerocarpa Ell.
Coastal Zone.

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Gratiola pilosa Michx. Hairy Hedge-hyssop.
Coastal Zone; in moist sandy soil in both forests and open situations; frequent.

Ilysanthes gratioloides (L.) Benth. False Pimpernel.
Throughout the state; in open wet stuations, preferring bare mud; common.

Ilysanthes attenuata (Muhl.) Small. False Pimpernel.
Baltimore County, near Towson (Robert K. Miller).

Micranthemum micranthemoides (Nutt.) Wettst.
Coastal Zone; on mud flats subject to tidal overflow; rare.
Wicomico County, near Salisbury (1264).

Limosella tenuifolia Hoffm. Mudwort.
Coastal Zone; gravelly shores of fresh tidal estuaries; rare.
Kent County, Lloyds Creek (1703).

Veronica americana Schwein. American Brooklime.
Midland Zone; in moist forests and flood plains; frequent.

Veronica officinalis L. Speedwell.
Throughout the state; in dry fields and open situations; common.

Veronica serpyllifolia L. Thyme-leaved Speedwell.
Midland Zone; in dry open situations; frequent.

Veronica peregrina L. Purslane Speedwell.
Throughout the state; in moist open situations and in swamps; common.
Wicomico County, Tonytank Creek (1180).

Veronica arvensis L. Corn Speedwell.
Throughout the state; in dry forests, fields and waste places; common.
Introduced from Europe.

Leptandra virginica (L.) Nutt. Culvers-root.
Infrequent in the Upper Midland District, common in the Mountain Zone; in wet and moist open situations,
Garrett County, Mountain Lake Park (1948).

Buchnera americana L. Blue-hearts.
Harford County, Edgewood (Robert K. Miller).

Dasystoma pedicularia (L.) Benth. Fern-leaved False Foxglove.
Infrequent in the Coastal Zone, common in the Midland and Mountain Zones; in dry forests.

Dasystoma laevigata Raf. Entire-leaved False Foxglove.
Throughout the state; in dry forests; common.

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Dasystoma virginica (L.) Britton. Smooth False Foxglove.
Infrequent in the Midland Zone, common in the Mountain Zone; in dry forests.
Garrett County, Mountain Lake Park (1954).

Gerardia purpurea L. Purple Gerardia.
Throughout the state; in dry forests and open situations; common.

Gerardia maritima Raf. Marsh Gerardia.
Coastal Zone; in salt and brackish marshes; frequent.

Gerardia tenuifolia Vahl. Slender Gerardia.
Baltimore County, near Towson (Robert K. Miller).

Castilleja coccinea (L.) Spreng.
Mountain Zone; in moist and dry forests; frequent.
Garrett County, Mountain Lake Park (545).

Pedicularis lanceolata Michx. Swamp Lousewort.
Coastal and Midland Zones; in open wet situations; rare.
Talbot County, Tuckahoe Bridge (1653); Baltimore County, near Cockeysville (Robert K. Miller).

Pedicularis canadensis L. Betony.
Infrequent in the Coastal Zone, common in the Midland and Mountain Zones; in dry and moist forests.

Melampyrum lineare Lam. Cow-wheat.
Throughout the state; in dry forests; common.
Queen Anne's County, near Sudlerville (1681).

LENTIBULARIACEAE.

Utricularia cornuta Michx. Horned Bladderwort.
Anne Arundel County, near the head of the Magothy River (Robert K. Miller).

Utricularia juncea Vahl. Rush Bladderwort.
Worcester County, Greenbackville (1110).

Utricularia inflata Walt. Swollen Bladderwort.
Coastal Zone; in ponds and slow streams; infrequent.
Dorchester County, near Hurlock (1620).

Utricularia vulgaris L. Greater Bladderwort.
Common in the Coastal Zone in ponds and slow streams, apparently absent from the Midland Zone.
Kent County, near Betterton (1707).

Utricularia clandestina Nutt. Hidden-fruited Bladderwort.
Harford County, near Bengies (Robert K. Miller).

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Utricularia fibrosa Walt. Fibrous Bladderwort.
Anne Arundel County, Glenburnie (Robert K. Miller).

Utricularia gibba L. Humped Bladderwort.
Coastal and Midland Zones; in ponds and streams; frequent.
Worcester County, Boxiron (1067).

OROBANCHACEAE.

Thalesia uniflora (L.) Britton. Cancer-Root.
Throughout the state; in rich forests; being most frequent in the Midland Zone.
Harford County, Glenville (1567).

Conopholis americana (L. f.) Wallr. Squaw-Root.
Midland and Mountain Zones; in rich forests; infrequent.

Leptamnium virginianum (L.) Raf. Beech-Drops.
Throughout the state; in rich forests; parasitic on **Fagus americana**.

BIGNONIACEAE.

Bignonia crucigera L. Cross-vine.
Coastal Zone; in river swamps of the Pocomoke; rare.
Somerset County, near Pocomoke City (1144).

Tecoma radicans (L.) DC. Trumpet Creeper.
Coastal Zone, and along the Potomac River for about 20 miles above Washington; in forests and open situations; common.

ACANTHACEAE.

Ruellia strepens L. Smooth Ruellia.
Montgomery County, Cabin John (Robert K. Miller).

Ruellia ciliosa Pursh. Hairy Ruellia.
Throughout the state; in dry open situations; infrequent.
Kent County, near Chestertown (1696).

Dianthera americana L. Water-willow.
Rare in the Coastal Zone (where it is known only from the sandy shores of the Sassafras River near Betterton), common in the Midland and Mountain Zones, where it is confined to saturated gravel or stony soil in stream beds.
Washington County, Hancock (698).

PHRYMACEAE.

Phryma leptostachya L. Lopseed.
Rare in the Coastal Zone, and in the Lower Midland District, common in the Upper Midland District and the Mountain Zone; in moist and dry forests.
Washington County, near Hancock (804).

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PLANTAGINACEAE.

Plantago major L. Common Plantain, White-man's-foot.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Plantago rugelii Dec.
Throughout the state; in cultivated grounds; common.

Plantago lanceolata L. Rib-grass, English Plantain.
Throughout the state; in cultivated and waste places; common.

Plantago aristata Michx. Large-bracted Plantain.
Throughout the state; in cultivated and waste places; locally common. Introduced from the western states.

Plantago virginica L. Dwarf Plantain.
Throughout the state; in dry open situations; frequent.

RUBIACEAE.

Houstonia coerulea L. Bluets.
Throughout the state; in dry forests and open situations; common.

Houstonia purpurea L. Large Houstonia.
Throughout the state; in forests and open situations; common.
Talbot County, near Easton (1523).

Houstonia longifolia Gaert. Long-leaved Houstonia.
Throughout the state; in dry forests and open situations; common.
Washington County, Hancock (696).

Oldenlandia uniflora L. Clustered Bluets.
Wicomico County, Salisbury (Robert K. Miller).

Cephalanthus occidentalis L. Button-bush.
Common in the Coastal and Midland Zones, infrequent in the Mountain Zone; in swamps and open wet situations and along streams.

Mitchella repens L. Partridge-berry.
Throughout the state; in moist sandy forests in the Coastal Zone and Midland Zones, and on shaded sandstone cliffs; common.

Diodia teres Walt. Rough Button-weed.
Throughout the state; in dry forests and open situations; common.

Diodia virginiana L. Larger Button-weed.
Coastal Zone; in upland swamps and open wet situations, preferring sandy soil; common in Worcester County.
Worcester County, Snow Hill (1041).

Galium verum L. Yellow Bedstraw.
Garrett County, Oakland (477).

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Galium aparine L. Cleavers.
Throughout the state; in forests and open situations; common. Introduced from Europe.

Galium pilosum Ait. Hairy Bedstraw.
Throughout the state; in dry forests; frequent.
Washington County, Hancock (697).

Galium pilosum var. puncticulosum (Michx.) T. & G.
Wicomico County, Quantico (1353).

Galium lanceolatum Torr.
Midland and Mountain Zones; in dry forests; frequent.
Washington County, near Hancock (818).

Galium circaezans Michx. Wild Liquorice.
Throughout the state; in moist and dry woods; common.
Washington County, Hancock (713).

Galium triflorum Michx. Fragrant Bedstraw.
Throughout the state; in moist and dry forests; frequent.
Garrett County, Oakland (548).

Galium latifolium Michx. Purple Bedstraw.
Washingon County, near Blue Ridge Summit (Robert K. Miller).

Galium tinctorium L. Wild Madder.
Throughout the state; in moist forests and open situations; common.
Allegany County, near Cumberland (986).

Galium tinctorium var. filifolium Wiegand.
Garrett County, Gorman (528).

Galium claytoni Michx.
Throughout the state; in wet situations; frequent.
Wicomico County, Tonytank Creek (1192).

Galium concinnum Torr. & Gray. Shining Bedstraw.
Throughout the state; in dry forests; frequent.
Washington County, Hancock (756).

Galium hispidulum Michx. Coast Bedstraw.
Coastal Zone; in sandy forests and open situations; infrequent.
Wicomico County, near Salisbury (Robert K. Miller).

CAPRIFOLIACEAE.

Sambucus canadensis L. Elder.
Throughout the state; in open wet situations and along streams; common.

Sambucus pubens Michx. Red-berried Elder.
Mountain Zone; in moist forests of lower mountain slopes; infrequent.
Allegany County, Wills Mountain (866).

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Viburnum alnifolium Marsh. Hobble-bush.
Mountain Zone; in moist rocky forests, being most abundant in the shade of hemlocks.
Garrett County, Boiling Spring (1966).

Viburnum acerifolium L. Maple-leaved Viburnum.
Throughout the state; in moist and dry forests; common.
Baltimore, Walbrook (428).

Viburnum pubescens (Ait.) Pursh. Downy-leaved Viburnum.
Midland and Mountain Zones; in dry forests; infrequent.
Allegany County, near Flintstone (1020).

Viburnum dentatum L. Viburnum.
Throughout the state; in swamps and moist forests; common.
Garrett County, near Oakland (527).

Viburnum molle Michx. Soft-leaved Viburnum.
Baltimore County, near Ashland (Robert K. Miller).

Viburnum venosum Britton. Coastal Viburnum.
Wicomico County, Tonytank Creek (1187).

Viburnum cassinoides L. Appalachian Tea.
Rare in the Midland Zone, common in the Mountain Zone; in swamps and bogs.
Baltimore County, near Towson (Robert K. Miller); Garrett County, Thayerville (2056).

Viburnum nudum L. Withe-rod.
Common in the Coastal Zone, known from a single locality in the Midland Zone; in swamps and open wet situations, being most abundant in sandy swamps.
Baltimore County, near Towson (Robert K. Miller); Worcester County, near Rehoboth (1153).

Viburnum prunifolium L. Black Haw.
Throughout the state; in moist and dry forests and in open situations; common.
Somerset County, Marion (1259).

Triosteum perfoliatum L. Fever-wort, Horse-gentian.
Midland Zone; in dry forests and open situations; frequent.
Washingon County, Hancock (702); Dorchester County, near Bucktown (1617).*

Triosteum angustifolium L. Yellow Horse-gentian.
Baltimore, Walbrook (W. Ralph Jones).

*Both of these numbers were determined by the United States National Herbarium as *Triosteum aurantiacum* Bicknell.

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Symphoricarpos symphoricarpos (L.) MacM. Coral-Berry.
Midland Zone; near cultivated grounds. An escape from cultivation.
Baltimore County, Towson (Robert K. Miller).

Lonicera sempervirens L. Coral Honeysuckle.
Coastal Zone; in moist and dry thickets; common.

Lonicera japonica Thunb. Japanese Honeysuckle.
Midland and Mountain Zones; in open situations; common. Introduced from Asia.

Lonicera ciliata Muhl. Fly Honeysuckle.
Mountain Zone; along streams in hemlock forests; rare.
Garrett County, Boiling Spring (2045).

Diervilla diervilla (L.) MacM. Bush Honeysuckle.
Rare in the Midland Zone, frequent in the Mountain Zone; on rocky slopes.
Garrett County, Swanton (2014).

VALERIANACEAE.

Valerianella locusta (L.) Bettke. European Corn Salad.
Midland; in waste situations; infrequent. Introduced from Europe.

Valerianella chenopodifolia (Pursh.) DC. Goose-foot Corn Salad.
Montgomery County, Great Falls (Robert K. Miller).

Valerianella radiata (L.) Dufr. Beaked Corn Salad.
Baltimore County, Loch Raven (Robert K. Miller).

DIPSACACEAE.

Dipsacus sylvestris Huds. Wild Teasel.
Throughout the state; in waste grounds; most common in the Midland Zone. Introduced from Europe.

CUCURBITACEAE.

Micrampelis lobata (Michx.) Greene. Mock Apple.
Throughout the state; in open situations; infrequent.

Sicyos angulatus L. Bur-cucumber.
Throughout the state; in thickets and open situations; frequent.
Cecil County, Barksdale (397).

CAMPANULACEAE.

Campanula rotundifolia L. Harebell.
Found just outside the state at Cedar Cliff, Mineral County, West Virginia (1913).

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Campanula aparinoides Pursh. Marsh Bellflower.
Throughout the state; in open wet situations; infrequent.
Queen Anne's County, near Sudlerville (1675).

Campanula americana L. Tall Bellflower.
Midland and Mountain Zones; in moist forests; frequent.
Washington County, Round Top (726).

Legouzia perfoliata (L.) Britton. (*Specularia.*) Venus's Looking-glass.
Throughout the state; in dry open situations, preferring sandy soil; common, particularly in the Coastal Zone.

Lobelia cardinalis L. Cardinal Flower.
Throughout the state; in swamps and along streams; common.

Lobelia syphilitica L. Great Lobelia.
Midland Zone; in moist forests and open situations; frequent.

Lobelia puberula Michx. Downy Lobelia.
Throughout the state; in moist forests; infrequent.

Lobelia spicata Lam. Spiked Lobelia.
Throughout the state, being more abundant in the Midland and Mountain Zones; in moist and dry forests.
Garrett County, Oakland (551).

Lobelia inflata L. Indian Tobacco.
Throughout the state; in forests and open situations; common.

Lobelia nuttallii R. & S. Nuttall's Lobelia.
Coastal Zone; in open situations, preferring sandy soil; frequent.
Worcester County, Greenbackville (1124).

Lobelia elongata Small.
Worcester County, Wagram (1166).

CICHORIACEAE.

Cichorium intybus L. Chicory.
Throughout the state; in cultivated and waste grounds; locally common.

Adopogon dandelion (L.) Kuntze. Dwarf Dandelion.
Midland and Mountain Zones; in moist forests; infrequent.
Montgomery County, Great Falls (1429).

Adopogon carolinianum (Walt.) Britton. Carolina Dwarf Dandelion.
Throughout the state; in open dry situations; common, particularly on sandy soil in the Coastal Zone.

Chondrilla juncea L. Gum Succory.
Coastal Zone; in dry forests and waste situations; common in the Western Shore District of the Coastal Zone, rare in the Eastern Shore. Introduced from Europe.
Wicomico County, Salisbury (1173).

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Taraxicum taraxicum (L.) Karst. Common Dandelion.
Throughout the state; in cultivated grounds and waste situations; common. Introduced from Europe.

Sonchus oleraceus L. Hare's Lettuce.
Throughout the state; in waste situations; common.

Sonchus asper (L.) All. Spiny Sow-Thistle.
Throughout the state; in waste situations; frequent.

Lactuca scariola L. Prickly Lettuce.
Throughout the state; in waste situations; locally common. Introduced from Europe.

Lactuca canadensis L. Wild Tall Lettuce.
Throughout the state; in forests and open situations; common.
Cecil County, Conowingo (407).

Lactuca hirsuta Muhl. Hairy Wood-Lettuce.
Baltimore County, near Towson (Robert K. Miller).

Lactuca sagittifolia Ell. Arrow-leaved Lettuce.
Washington County, Hancock (W. Ralph Jones).

Lactuca floridana (L.) Gaert. Florida Lettuce.
Baltimore (W. Ralph Jones).

Lactuca spicata (Lam.) Hitchcock. Blue Lettuce.
Midland Zone; in moist forests; frequent.
Allegany County, near Cumberland (1919).

Lactuca villosa Jacq.
Coastal Zone.

Hieracium venosum L. Veined Hawkweed, Rattlesnake Weed.
Throughout the state; in dry forests; common.
Cecil County, Conowingo (408).

Hieracium marianum Willd. Maryland Hawkweed.
Baltimore County, Timonium (Robert K. Miller).

Hieracium paniculatum L. Panicled Hawkweed.
Upper Midland District and Mountain Zone; in moist and dry forests; common.
Frederick County, Thurmont (1757).

Hieracium scabrum Michx. Rough Hawkweed.
Throughout the state; in dry forests and open situations; frequent.
Talbot County, Easton (614).

Hieracium gronovii L. Hairy Hawkweed.
Common in the Coastal Zone; frequent in the Midland Zone; in dry forests.
Baltimore County, Towson (Robert K. Miller).

Nabalus albus (L.) Hook. Rattlesnake-root.
Throughout the state; in moist and dry forests; common.

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Nabalus serpentarius (Pursh.) Hook. Lion's-foot.
Cecil County, Conowingo (407).

Nabalus trifoliatus Cass. Tall Rattlesnake-root.
Baltimore County, Warren (Robert K. Miller).

AMBROSIACEAE.

Iva frutescens L. Marsh Elder.
Coastal Zone; along the margins of salt and brackish marshes, and along the banks of estuaries; common.

Ambrosia trifida L. Great Ragweed.
Throughout the state; in moist waste situations; common.

Ambrosia trifida var. integrifolia (Muhl.) Torr. & Gray.
Throughout the state; in waste situations; frequent.

Ambrosia artemisiaefolia L. Ragweed.
Throughout the state; in cultivated and waste grounds; one of the most common weeds.

Xanthium spinosum L. Spiny Clotbur.
Throughout the state; in waste situations; infrequent. Introduced from Europe.
Cecil County, Charlestown (398).

Xanthium glabratum (DC.) Britton. Smooth Clotbur.
Baltimore (W. Ralph Jones).

Xanthium canadense Mill. Cocklebur.
Throughout the state; in dry waste grounds; common.

COMPOSITAE.

Vernonia noveboracensis (L.) Willd. Iron Weed.
Throughout the state; in marshes, swamps, open wet situations and cultivated grounds; common.

Elephantopus carolinianus Willd. Carolina Elephant's-foot.
Common in the Coastal Zone, rare in the Midland Zone; in dry forests.

Elephantopus nudatus A. Gray. Smoothish Elephant's-foot.
Coastal Zone; in dry forests of the southern Eastern Shore; frequent.
Worcester County, Snow Hill (1049).

Sclerolepis uniflora (Walt.) Porter.
Coastal Zone; sandy lake margins; rare.
Wicomico County, Humphrey Pond (1346).

Eupatorium purpureum L. Joe-pye Weed.
Throughout the state; in moist open situations; common.

Eupatorium verbenaefolium Michx.
Coastal and Midland Zones.

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Eupatorium hyssopifolium L. Hyssop-leaved Thoroughwort.
Coastal Zone; in moist open situations; frequent.
Worcester County, Herring Creek (659).

Eupatorium altissimum L. Tall Thoroughwort.
Upper Midland District and Mountain Zone; in dry forests; frequent.
Allegany County, Cumberland (1009a).

Eupatorium sessilifolium L. Upland Boneset.
Midland and Mountain Zones; in dry forests; infrequent.
Allegany County, Piney Mountain (919).

Eupatorium rotundifolium L. Wild Horehound.
Throughout the state; in marshes, swamps, and moist open situations; common.

Eupatorium perfoliatum L. Boneset.
Throughout the state; in moist open situations, marshes and swamps; common.

Eupatorium ageratoides L. White Sanicle.
Throughout the state, being most common in the Mountain Zone; in dry forests.

Eupatorium coelestinum L. Mist-Flower.
Cecil County, Chesapeake City (404).

Willughbaeya scandens (L.) Kuntze. Climbing Boneset.
Throughout the state; in marshes and moist open situations; common.

Lacinaria squarrosa (L.) Hill. Scaly Blazing Star.
Charles County, Marshall Hall (M. A. Chrysler).

Lacinaria scariosa (L.) Hill. Large Button-snakeroot.
Mountain Zone; in dry forests; frequent.
Allegany County, Wills Mountain (1935).

Lacinaria graminifolia var. pilosa (Ait.) Britton.
Coastal Zone and Lower Midland District.

Grindelia squarrosa (Pursh.) Dunal. Gum Plant.
Allegany County, Cumberland (George M. Perdew).

Heterotheca subaxillaris (Lam.) Britton & Rusby.
Wicomico County, Salisbury (1172).

Chrysopsis graminifolia (Michx.) Nutt. Golden Aster.
Wicomico County, Salisbury (1273).

Chrysopsis mariana (L.) Nutt. Maryland Golden Aster.
Throughout the state; in dry forests and open situations; common.

Solidago stricta Ait.
Midland Zone.

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Solidago caesia L. Blue-stemmed Golden Rod.
Throughout the state; in moist and dry forests; common.
Garrett County, Boiling Spring (1959).

Solidago flexicaulis L. Zig-zag Golden Rod.
Midland Zone; in moist forests; common.
Baltimore County, near Warren (2069).

Solidago bicolor L. White Golden Rod.
Throughout the state; in dry forests; common.
Talbot County, Easton (37).

Solidago monticola T. & G. Mountain Golden Rod.
Mountain Zone; moist forests and open wet situations; frequent.
Garrett County, Crellin (1986).

Solidago speciosa Nutt. Showy Golden Rod.
Garrett County, Oakland (2016).

Solidago sempervirens L. Seaside Golden Rod.
Coastal Zone; in marshes and swamps and on the strand; common.
Talbot County, Easton (47).

Solidago odora Ait. Anise-scented Golden Rod.
Coastal Zone; in dry forests; common.
Talbot County, Easton (36).

Solidago rugosa Mill. Bitter Weed.
Throughout the state; in dry forests and open situations; common.

Solidago patula Muhl. Rough-leaved Golden Rod.
Baltimore County, near Cockeysville (Robert K. Miller).

Solidago juncea Ait. Sharp-toothed Golden Rod.
Midland Zone; in moist forests; infrequent.
Allegany County, Cumberland (949).

Solidago serotina Ait. Late Golden Rod.
Baltimore County, near Cockeysville (Robert K. Miller).

Solidago canadensis L. Canada Golden Rod.
Throughout the state; in dry forests and open situations; common.

Solidago nemoralis Ait. Field Golden Rod.
Throughout the state; in dry open situations; common.
Cecil County, Conowingo (410).

Solidago concolor T. & G. Hairy Golden Rod.
Midland Zone.

Euthamia graminifolia (L.) Nutt. Bushy Golden Rod.
Throughout the state; in dry situations; common.
Talbot County, Easton (40).

Sericocarpus linifolius (L.) B. S. P. White-topped Aster.
Throughout the state; in moist sandy soil; infrequent.
Worcester County, Ocean City (1240).

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Sericocarpus asteroides (L.) B. S. P.
Throughout the state; in dry forests; common.
Washington County, Hancock (817).

Aster divaricatus L. White Wood Aster.
Throughout the state; being infrequent in the Coastal Zone, common in the Midland and Mountain Zones; in moist and dry forests.
Garrett County, Boiling Spring (1967).

Aster schreberi Nees.
Baltimore County, near Cockeysville (Robert K. Miller).

Aster cordifolius L. Common Blue Wood Aster.
Throughout the state; in moist forests; common.
Garrett County, Swanton (1997).

Aster sagittifolius Willd. Arrow-leaved Aster.
Throughout the state; in dry forests and open situations; common.
Garrett County, Oakland (1941).

Aster undulatus L. Wavy-leaved Aster.
Throughout the state; in dry forests; common.
Baltimore County, Roland Park (272).

Aster patens Ait. Late Purple Aster.
Throughout the state; in dry situations; common.

Aster novae-angliae L. New England Aster.
Throughout the state; in moist forests and open situations; common.

Aster puniceus L. Red-stalked Aster.
Throughout the state; in moist forests, flood plains and swamps; common.
Garrett County, Oakland (1940).

Aster prenanthoides Muhl. Crooked-stem Aster.
Throughout the state; in moist and dry situations; common.
Garrett County, Crellin (1994).

Aster laevis L. Smooth Aster.
Throughout the state; in moist and dry forests; frequent.
Garrett County, Oakland (1951).

Aster spectabilis Ait. Seaside Purple Aster.
Coastal Zone; in marshes and open wet situations; frequent.
Wicomico County, near Vienna (1311a).

Aster acuminatus Michx. Mountain Aster.
Mountain Zone; in swamps and moist forests; infrequent.
Garrett County, Finzel (960).

Aster paniculatus Lam. Tall White Aster.
Throughout the state; in moist and dry situations; common.

Aster concinnus Willd.
Mountain Zone.

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Aster ericoides L. White Heath Aster.
Throughout the state; in dry forests and open situations; common.

Aster lateriflorus (L.) Britton. Calico Aster.
Throughout the state; in dry forests; frequent.
Baltimore County, Cockeysville (Robert K. Miller).

Aster multiflorus Ait. Dense-flowered Aster.
Baltimore County, near Cockeysville (Robert K. Miller).

Aster tenuifolius L. Perennial Salt Marsh Aster.
Coastal Zone; in salt and brackish marshes; common.

Aster subulatus Michx. Annual Salt Marsh Aster.
Coastal Zone; in salt marshes; frequent.
Worcester County, Herring Creek (643).

Erigeron pulchellus Michx. Robin's Plantain.
Midland and Mountain Zones; in moist forests; frequent.

Erigeron ramosus (Walt.) BSP.
Coastal Zone.

Erigeron annuus (L.) Pers. Daisy Fleabane.
Throughout the state; in cultivated grounds and waste situations; common.

Leptilon canadense (L.) Britton. Fleabane, Horseweed.
Throughout the state; in cultivated and waste grounds; common.

Doellingeria umbellata (Mill.) Nees. Flat-top Aster.
Throughout the state; in dry open situations; frequent.

Doellingeria humilis (Willd.) Britton.
Baltimore County, near Cockeysville (Robert K. Miller).

Ionactis linariifolius (L.) Greene. Stiff Aster.
Baltimore County, Catonsville (276).

Baccharis halimifolia L. Groundsel Tree, Beach Ivy.
Coastal Zone; along the shores of tidal estuaries and marshes; common.

Gifola germanica (L.) Dumort. Cudweed.
Throughout the state; in cultivated grounds; infrequent.

Pluchea foetida (L.) B. S. P. Marsh Fleabane.
Coastal Zone; in salt and brackish marshes; common in the southern Eastern Shore.
Worcester County, Greenbackville (1101).

Pluchea camphorata (L.) DC.
Coastal Zone; in salt and brackish marshes; common.
Worcester County, Greenbackville (1141).

Antennaria neodioica Greene. Cat's-foot.
Midland and Mountain Zones; in dry forests; common.
Washington County, Round Top (768).

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Antennaria neglecta Greene.
Baltimore County, Cockeysville (W. Ralph Jones).

Antennaria plantaginifolia (L.) Rich. Indian Tobacco.
Throughout the state; in dry forests and open situations; common.

Gnaphalium obtusifolium L. Sweet Everlasting.
Harford County, Pooles Island (M. A. Chrysler).

Gnaphalium purpureum L. Purple Cudweed.
Coastal Zone; in dry open situations; common.
Prince George's County, Upper Marlborough (1541).

Inula helenium L. Elecampane, Horseheal.
Midland and Mountain Zones; waste grounds in the vicinity of Cumberland. Introduced from Europe.
Allegany County, Midlothian (823).

Polymnia uvedalia L. Yellow Leaf-cup.
Throughout the state; in moist forests and open situations; frequent.
Allegany County, Cumberland (George M. Perdew).

Polymnia canadensis L. Small-flowered Leaf-cup.
Upper Midland District and Mountain Zone; in moist forests; frequent.
Washington County, Round Top (751).

Silphium trifoliatum L. Resin Weed.
Midland and Mountain Zones; in open situations; infrequent.
Allegany County, Cumberland (1931); Baltimore County, Loch Raven (Robert K. Miller).

Chrysogonum virginianum L.
Montgomery County, Great Falls (Robert K. Miller).

Heliopsis helianthoides (L.) B. S. P. False Sunflower.
Midland Zone; in moist and dry situations; infrequent.
Cecil County, North East (420).

Eclipta alba (L.) Hassk.
Throughout the state; in open wet situations; common.

Rudbeckia triloba L. Thin-leaved Cone-flower.
Montgomery County, Great Falls (Joseph H. Painter).

Rudbeckia hirta L. Black-eyed Susan.
Throughout the state; in dry open situations; common.

Rudbeckia fulgida Ait. Orange Cone-flower.
Baltimore County, Timonium (Robert K. Miller).

Rudbeckia laciniata L. Tall Cone-flower.
Throughout the state; in moist open situations; common.

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Helianthus angustifolius L. Narrow-leaved Sunflower.
Coastal Zone; in open moist situations, preferring sandy soil; infrequent.
Worcester County, Ocean City (1229).

Helianthus giganteus L. Tall Sunflower.
Throughout the state; in moist open situations; frequent.
Cecil County, Elkton (383).

Helianthus divaricatus L. Woodland Sunflower.
Midland and Mountain Zones; in dry forests; common.
Allegany County, Braddock Run (902).

Helianthus mollis Lam. Hairy Sunflower.
Prince George's County, Riverdale (Joseph H. Painter).

Helianthus decapetalus L. Thin-leaved Sunflower.
Throughout the state; in moist open situations; frequent.
Allegany County, Braddock Run (913).

Helianthus strumosus L. Pale-leaved Wood Sunflower.
Baltimore County, Warren (Robert K. Miller).

Verbesina occidentalis (L.) Walt. Crownbeard.
Throughout the state; in open situations; common.

Verbesina alternifolia (L.) Britton. Actinomeris.
Midland and Mountain Zones; in open situations; infrequent, except in the vicinity of Cumberland, where it is common.

Coreopsis verticillata L. Whorled Tickseed.
Midland Zone; in dry forests; locally frequent.
Montgomery County, Laytonsville (1730).

Coreopsis tripteris L. Tall Tickseed.
Montgomery County, Great Falls (Robert K. Miller).

Bidens laevis (L.) B. S. P. Smooth Bur-marigold.
Throughout the state; in moist open situations; common.

Bidens beckii Torr. Water Marigold.
Coastal Zone.

Bidens cernua L. Nodding Bur-marigold.
Cecil County, Elkton (375).

Bidens bipinnata L. Spanish Needles.
Throughout the state; in dry and moist situations; common.

Bidens trichosperma var. tenuiloba (A. Gray) Britton.
Coastal Zone; in tidal marshes; common.
Worcester County, Rehoboth (1154).

Galinsoga parviflora Cav. Galinsoga.
Throughout the state; in cultivated grounds and waste places; common.
Introduced from South America.

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Helenium autumnale L. Sneezeweed.
Throughout the state; in moist open situations; common.

Achillaea millefolium L. Yarrow, Milfoil.
Throughout the state; in open situations; common.

Anthemis cotula L. May-weed.
Throughout the state; in cultivated grounds and waste places; common. Introduced from Europe.

Chrysanthemum leucanthemum L. Common Daisy.
Throughout the state; in cultivated grounds and waste places; common. Introduced from Europe.

Arnica acaulis (L.) B. S. P. Leopard's-bane.
Baltimore County, Towson (Robert K. Miller).

Erechtites hieracifolia (L.) Raf. Fire-weed.
Throughout the state; in cultivated and waste grounds, being particularly common in burns and slashes in forests.

Mesadenia reniformis (Muhl.) Raf. Great Indian Plantain.
Baltimore County, near Warren (Robert K. Miller).

Mesadenia atriplicifolia (L.) Raf. Pale Indian Plantain.
Throughout the state; in forests and open situations; common, excepting in the sandy portions of the Coastal Zone.

Senecio tomentosus Michx. Wooly Ragwort.
Coastal Zone; in forests and open situations; frequent in the southern counties of the Eastern Shore.

Senecio balsamitae Muhl. Balsam Groundsel.
Throughout the state; in dry situations; frequent.
Garrett County, Oakland (560).

Senecio aureus L. Golden Ragwort.
Rare in the Coastal Zone; common in the Midland and Mountain Zones; in moist forests.
Garrett County, Oakland (542).

Senecio obovatus Muhl. Squaw Weed.
Upper Midland District.

Arctium minus Schk. Burdock.
Throughout the state; in cultivated grounds; common. Introduced from Europe.

Arctium lappa L. Great Burdock.
Coastal Zone, naturalized from Europe.

Carduus altissimus L. Tall Thistle.
Montgomery County, Cabin John (Robert K. Miller).

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Carduus discolor. Field Thistle.
Throughout the state; in cultivated and waste grounds; frequent.

Carduus lanceolatus L.
Coastal Zone, introduced from Asia.

Centaurea cyanus L. Corn-flower, Corn Blue Bottle.
Throughout the state; in cultivated grounds; locally common. Introduced from Europe.
Charles County, Cox (1540).

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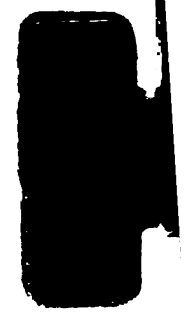

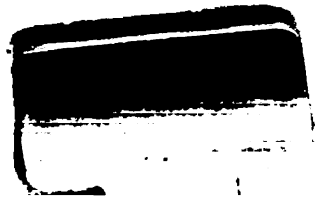

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